Forecasting Tourist Arrivals in Greece and the Impact of Unemployment Shocks from the Countries of Tourists' Origin

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Abstract: This study provides forecasts of tourist arrivals for the most popular destinations in Greece, using the ARIMA and Holt-Winters (H-W) forecasting models. The Holt-Winters (H-W) approach forecasts increase in tourism, while the ARIMA model yields mixed results. Furthermore, we find that the H-W model outperforms the ARIMA model in every criterion used. Additionally, we analyze the impact of unemployment shocks in the country of tourists' origin on future tourist arrivals using the Impulse Response Sims (1980) VAR model. The source of risk to future tourism arrivals originates from France, and to a lesser extent, from Germany and the Netherlands. Further, the size of the impact and duration of the response varies among destinations, offering important implications for policymakers and tourist operators.

Keywords: Tourism Econometrics, Greece, Air-Transport, Tourist Arrivals, Unemployment Shocks, H-W Exponential Model, Impulse Response Sims (VAR) Model

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INTRODUCTION

The tourist industry is one of the most crucial sectors for a thriving economy as it accounts for a large part of countries' Growth Domestic Product (GDP) and employment figures (González, and Moral, (1996)). Tourism is characterized by large variations in numbers on a yearly basis and, as a result, predicting future arrivals is a very difficult task. Forecasts of tourist arrivals are essential for planning, policy making and budgeting purposes by tourism operators (Uysal and O'Leary (1986)).

In response to this, a number of studies have been conducted in several countries to forecast tourist demand and arrivals (e.g. Law (2000) for Taiwan and Hong Kong, Burger, Dohnal, Kathada and Law (2001) for South Africa and Chu (2008) for nine major tourist destinations in the Asian-Pacific region, Dharmaratne, (1995) and Dalrymple and Greenidge, (1999) for Barbados, González, and Moral, (1996) for Spain, Chu (2004), Song and Witt (2006), Chu (2009) for Asian-Pacific countries, Lim and McAleer, (2001), Athanasopoulos and Hyndman (2008) for Australia, Smeral and Weber (2000) and Papatheodorou and Song (2005) for international tourism trends and Shen, Li and Song (2010) for UK outbound tourism demand) under the research framework that the tourist industry is a key sector in the economic development strategy of many developing countries.

Despite an ever expanding literature in this area, no study to our knowledge has attempted to forecast future arrivals in major tourist destinations in Greece. According to the National Statistical Service of Greece, in 2002 the country saw 14.9 million international tourists visit Greece placing it the 12^{th} place most visited destination internationally. This yielded an income of $9.74 billion, boosting Greece in the top ten in the world. With Greece being one of the top tourist destinations and with a tourism industry that contributes 17.2% of GDP and 20.9% of total employment (see WTTC, 2008) of the country, it is of paramount importance for policy makers and industry that forecasting models are developed and tested to provide an accurate and reliable picture of future tourism arrivals in Greece.

Hence, the first objective of this paper is to forecast tourist arrivals for the most popular destinations in Greece from 2010 to 2015 by employing established forecasting models on annual data from 1977 to 2009. The destinations considered include: the two biggest cities (Athens and Thessaloniki), the two biggest islands (Crete and Rhodes), the three famous Ionian islands (Corfu, Zante and Kefalonia), two “hot” destinations, particularly in the recent years, Mykonos and Santorini and three other islands of the Aegean Sea (Kos, Skiathos and Samos).

The second objective of the paper is to investigate, for the first time in a related study, the impact of unemployment shocks in the countries of tourists’ origin on tourist arrivals by utilizing a system of equations on monthly data from 1977 to 2009. This is performed by introducing a random shock into a system of equations to gauge how long it continues to impact future arrivals. The potential effects of unemployment in the countries of origin on future arrivals can firstly be found in the literature on “the wage curve” hypothesis. This theorem is based on the relationship between unemployment in the local labour market and the level of pay, where real wages are hypothesized to be negatively related to the unemployment rate. Early studies have reported convincing evidence that the level of pay is lower in areas of high unemployment (Blanchflower and Oswald (1990, 1994)) based on the unemployment elasticity of wages measure.

Further support is provided from studies that examine European countries and attempts to estimate the wage curve using data from the 1980’s and 1990’s (i.e., before the creation of the euro zone). For instance, Wagner (1994), Estevao and Nargis (2002) and Montuenga, Garcia and Fernandez (2003) among others consistently document an elasticity of approximately -0.01 across different European countries. Similarly, Deller and Tsai (1998) reach the same conclusion for the U.S. Further support, provided in a summary of evidence by Blanchflower and Oswald (2006), highlighted the validity of the wage curve theorem across 40 countries. Whilst Galdeano and Turunen (2005) report similar findings in their study on wage rigidity in the euro zone, they find the elasticity of unemployment to wages varies between the public and private sector.

Another strand in the literature that justifies the use of unemployment lies in the growing body of work on the psychological effect of unemployment on the level of happiness and well being. One conclusive finding that was held relatively unchallenged is that the level of unemployment reduces the level of happiness and well being significantly. For instance, Blanchflower (1996, 2001), amongst others, reaches this conclusion after investigating twenty-three different countries. Further support for this finding is provided by Ahn, Garcia and Jimeno (2004) who examine this effect for all countries in the European Community. They find evidence that unemployment reduces the level of satisfaction both in financial terms and vocational activity. This finding varies across countries, with unemployment in Denmark and the Netherlands having the least sensitive impact on well being.

Taken together, it is plausible to argue that unemployment levels, having a major effect on real wages, as well as people's level of happiness and well being, could affect the level of tourism activity. With no evidence available from previous studies, investigating the impact of unemployment on tourism activity will provide a more complete picture for policymakers on future arrivals especially in times of high unemployment that could feed into short to medium term forecasts.

We apply two models of forecasting that are well documented in the literature. First, we use the ARIMA model, which is a standard approach to generate *ex post* forecasts. This approach has been highlighted as a good forecasting tool when compared with other models (Preez and Witt (2003) and Chu (2009)). Second, we use the Holt-Winters (H-W) trend-corrected seasonal exponential smoothing model. This approach takes advantage of trends in the data and any evidence of seasonality which has been found to outperform other exponential models in forecasting tourist demand (Lim and McAleer (2001)). The intuition behind the use of two different models is to provide a robustness test of the forecasts and hence performance to determine their usefulness as forecasting tools for policymakers.

Other than being the first to investigate the impact of unemployment on future tourism arrivals, this paper also provides a methodological contribution by employing the Vector Autoregressive Model of Sims (1980). In addition to providing inferences on the wage curve hypothesis and the psychological effect on the level of happiness and well-being, this approach allows the introduction of unemployment shocks in the system to analyze its impact on future tourism levels. Based on the above, we hypothesize that periods of high unemployment will lead to a fall in tourism arrivals going forward. Hence, simulating impulse responses will provide some information on the size of the reaction and the duration of the effects on future arrivals.

Confidence bands are computed using Monte Carlo Simulation to determine the statistical reliability of the response.

The forecast results were not surprising. We find that the Holt-Winters (H-W) trend-corrected seasonal exponential smoothing model generally forecasts an increase in tourist arrivals from 2010 to 2015 on 2009 levels, a finding that is consistent with the historical trends dating back to 1977. On the other hand, the ARIMA model forecasts yield mixed directional forecasts among destinations. Furthermore, with the exception of three islands (Rhodes, Corfu and Crete) the directional forecasts are not robust in relation to the H-W approach. Additionally, we find that the H-W exponential model vastly outperforms the ARIMA in every criterion used, a finding that contradicts the general conclusions of previous studies.

Based on impulse responses, the results reveal that unemployment shocks originating from France, and to a lesser extent from Germany and the Netherlands, are identified as the greatest source of risk to future tourism arrivals. However, the magnitude of the response, the rate of decay and the duration varies among destinations. The findings also identify future arrivals to Kos, Santorini and Mykonos as being most at risk as a result of unemployment shocks, however the response is temporary. As a result, our findings cast doubt on the wage curve hypothesis as a plausible explanation behind the relationship between unemployment and tourism arrivals. Furthermore, our results also show future tourism arrivals are most insensitive to unemployment shocks originating from the U.K., U.S. and Turkey. Therefore, this poses question marks on the wage curve hypothesis as a plausible explanation behind the risks to future tourism activity.

To sum up, there are three main contributions in this paper. First, we forecast tourist arrivals in Greece, a top tourist country globally, and many of its popular tourist destinations. Given the importance of the tourism industry in Greece and the level of tourist demand, this study addresses a major gap in the literature. Our results offer very interesting insights regarding the tourism activity in Greece over the next years. Second, we explore the impact of unemployment shocks from the country of origin on future tourism arrivals in each destination. Third, we offer a methodological contribution by employing a Vector Autoregressive Model and simulating impulse responses following the introduction of unemployment shocks into the system to analyze how it impacts on future tourism arrivals. This provides useful information to policy makers to identify the source of risk to arrival numbers in the future.

1. DATA

1.1. Sample

To conduct this study, our database consists of monthly and annual data on tourist numbers and unemployment levels from the country of origin between 1977 and 2009. Using annual tourist numbers provides sufficient data to generate *ex post* forecasts from 2010 to 2015 for our forecasting models. On the other hand, monthly unemployment data, in addition to tourism numbers, are required to obtain enough observations to implement a system of equations approach and investigate how unemployment shocks impact on future tourism arrivals.

Tourism data was collected from a variety of different sources. First, data regarding the arrivals in Greece and countries of tourists' origin were mainly obtained from the Hellenic Statistical Authority. Cross checks and additional information were extracted from airlines, cruise companies, travel industry sources, big tourism operators, such as the Association of British Travel Agents (ABTA), the International Air Transport Association (IATA), the Greek National Tourism Organisation (GNTO), the Association of Greek Tourist Enterprises (SETE), the Hellenic Association of Travel & Tourist Agencies, the European Travel Commission (ETC), the General Secretariat of National Statistical Service of Greece (NSSG) – Ministry of Economy and Finance, Athens International Airport (Eleftherios Venizelos), Mediterranean Cruise Ports (MedCruise), Piraeus Port Authority SA and the UK Office for National Statistics. Unemployment data for the U.K., U.S., Japan, France, Germany, Italy, the Netherlands and Turkey was downloaded from the Datastream.

Owing to issues concerning data availability, the database comprised of voluntary unemployment figures for Italy, the Netherlands and Turkey along with unemployment figures in excess of vacancies for Japan. The start date is determined by the availability of data on tourist arrivals for Greece to ensure consistency. To provide further intuition behind the relationship between unemployment levels in the country of origin and tourist arrivals in Greece, we downloaded end of year general employment levels for the aforementioned countries from the Laborsta organization.

1.2. Historical Trends

1.2.1. Tourist Arrivals

The tourist arrivals from 1977-2009 are presented in Table 1. The table considers the most popular destinations in Greece, namely Athens and Thessaloniki, the second largest city in Greece, and the main Islands. Crete is the biggest island and is located at the south part of the country. Rhodes and Corfu are two islands which stand at the east (Aegean Sea) and west (Ionian Sea) coasts of Greece, respectively. Our sample covers two more Islands of the Ionian Sea, namely Kefalonia and Zante. Further, we study two cosmopolitan islands of the Cyclades cluster, Mykonos and Santorini and three more islands which are spread out in the Aegean Sea, Kos (very popular to British tourists), Samos and Skiathos.

The statistics indicate a rapidly increasing trend in the 1980's starting in 1983 to reach a peak in 1994 with 11.2 million tourists. It is noteworthy to mention that Greek tourism underwent much development during this period whereby increases in tourism arrivals were registered for twelve out of the thirteen years mainly due to strategies encouraged by the country's policymakers as the spatial polarization, the intensification of seasonality and the production and distribution of tourism consumption, Galani-Moutafi (2004).

During the 1990s, researchers have emphasized the increasing dependence on tour operators and intensified competition from newly emerging destinations (Briassoulis (1993), Buhalis (2000), Papatheodorou (2004)). The increased competition brought a mini crisis from 1994-1996 as arrivals declined. Greek Tourism Authorities reacted quickly by following experts' suggestions that available accommodation types and tourism "products" and activities had to change. Implementation of right strategies resulted in six consecutive years (1996-2002) of continuous increase (Konsolas and Zacharatos (2000)).

Table 1 also shows that during the Olympic year arrivals fell by more than half a million from 2003 level when approximately 15 million tourists visited Greece. This was viewed as an unexpected drop by the Greek authorities, which had predicted that the Games would boost arrivals well beyond that figure. This, however, was not the case. The drop in arrivals in 2004 could be attributed to a number of factors – fears that the Games might have been targeted by terrorists (unwarranted as it turned out), adverse publicity surrounding the tardiness of the construction of Olympic installations and a lack lustre advertising campaign.

The publicity, coupled with a wider choice of tourism products, packages designed for niche markets (city breaks, activity holidays, culture tours and the like, new carriers serving Athens International Airport (Papatheodorou and Lei, (2010)) and themed advertising campaigns - 'Live your Myth in Greece', 'Explore Your Senses' and 'The True Experience' in the years following 2004, have all contributed to increases in tourist' arrivals. The outcome of the continuing improvement in the supply of tourism services reached a peak of 17.1 million of tourists who visited Greece in 2007. During that period, issues concerning tourism planning and management were developed, often combined with proposals for more even spatial distribution of tourism benefits. The protection of the environment and the promotion of a sustainable type of development further comprised the central axis of many such research endeavours for this period (Coccossis and Parpairis (1995)).

The two years followed (2008 – 2009) clearly show a decline, which is mainly attributable to the global financial crisis and increased competition from newer holiday hot spots, such as Montenegro, Croatia, Turkey offering similar attractions. Greece has a high percentage of repeat customers, but as a member of the Eurozone, it is more expensive than some of the up-and-coming destinations and less appealing to those on a fixed income (retirees for instance) or families seeking a budget holiday (Alegre, Mateo and Pou (2010)).

Large investments over the past thirty years have been made for the construction of airports in the Greek islands increased tourist arrivals dramatically. For instance, in Santorini, the number of tourists increased from a few hundred in 1977 to 192,000 in 2007 with more than 50 flights over the summer.

In contrast, Athens' average annual growth rate has only been 2.48% (1.61% after the launch of Eleftherios Venizelos International Airport in 2001) over the same period. This can be attributed to the very expensive taxes of Athens Airport and the option that many tourists have to fly directly to their tourist destinations. The increase in air traffic through Athens over the last years has been fuelled by its growth as a popular venue for city breaks and a destination for meetings and conventions. Athens offers direct services to 116 destinations in 50 countries and has become the largest airline hub in southern Europe. It is expected that expansion of flights from European destinations to Greek islands will reduce even further the intermediate role of

Athens. The last double digit increase to Athens was 12.42% in 2005, one year after hosting the Olympic Games.

Thessaloniki, the second largest city in Northern Greece, has significantly lower airport taxes and it is a unique location which serves Halkidiki, one of the most popular tourist destinations in the country. These have led to an average annual growth rate of 3.57% (6.73% since 2000 or 500,000 more arrivals in eight years).

[Please Insert Table 1 About Here]

Table 2 reveals that tourist arrivals from Europe comprise the majority of foreign tourists in Greece. Tourist campaigns in the major capitals of Europe, in addition to advert spots in the media, served to encourage Europeans to visit Greece. For instance, Germany and the UK are the most important sources of tourism with an average annual growth rate of 5.37% and 6.14% respectively. Arrivals from the UK peaked at over three million in 2003 and since then there has been a steady drop of over 100,000 arrivals per year (a decrease of approximately 33% from the UK over the last seven years). This is mainly due to intense competition from other (and in some cases, lower-priced) destinations offered by tour operators, UK internal tourism destinations (Miller, Rathouse, Scarles, Holmes and Tribe (2010)) and the internet.

In Table 2, we also observe that the average annual growth rate of tourist arrivals from Italy and France (i.e., the third and fourth largest sources of tourists in Greece, respectively) was 6.37% and 6.47% respectively, over our sample period. It is surprising that Italy, a major European tourism destination, provides so many tourists to Greece. A possible explanation might be the cultural connection between Italians and the islands in the West Side of Greece (including Corfu, Zante and Kefalonia) as well as with Dodecanese Islands (including Rhodes and Kos) that were under the Italian territory until 1945. Corfu, the most popular island for Italian tourists, has excellent ferry connections with many ports in Italy which makes transportation relatively easier and cheaper.

Moreover, Greece’s neighbor countries, such as Albania and Bulgaria, are developing after decades of Communism. Greece may well benefit from the growing middle class in those countries that are now affluent enough to travel abroad. More than 84% of all inbound tourists originate from Western and Eastern Europe with Albania and Bulgaria already being among the leading source markets.

[Please Insert Table 2 About Here]

1.2.2. Unemployment Trends

In this study, we also examine the impact of unemployment shocks from the countries of origin on tourist arrivals in Greece. Table 3 provides a summary of unemployment figures, both yearly levels (Panel A) and percentage changes (Panel B), from the countries of origin between 1977 and 2009. Germany, the country with the largest number of tourists in Greece faced the highest unemployment increases during 1981 – 1983, 1990 – 1993 and 2003 – 2005 (See Panels A and B of Table 3). Surprisingly, in Table 2 we do observe a jump in tourists during the first period and little impact in the second period; however in 2003, Greek tourism faced a reduction of around ten per cent from German tourists relative to the previous year.

In the U.K., the second most important source of demand, tourist arrivals appear to be insensitive to increases in unemployment except during 2008 – 2009. Contrary to the general conclusions of Malley and Moutos (1996), significant increases in unemployment between 1980 –1982 and 1990–1992 were associated with increases in tourist numbers. According to Appendix 1, this may be attributable to the upward trend in employment levels over the past three decades, of which approximately 24.8 million people employed in 1977, had increased to around 30.8 million by 2005. However, the significant fall in unemployment between 1993 and 2000 was associated with the largest increase in tourist numbers in Greece over the same period. The recent global financial crisis hit the UK economy and its labor market substantially. The dramatic increase of unemployment in 2008–2009 coincided with a 19.26% reduction of British tourists who visited Greece. The recent announcement of the big deficit in the UK Economy and the reduction of salaries in a number of public sector jobs are predicted to lead to further reductions over the next years, Osborne (2010)

Italy has the unique characteristic of being a tourist destination for many European citizens. This country, being the third largest source of tourist arrivals in Greece faced upward trends in unemployment over the period 1978 – 1987, which subsequently declined between 1988 and 1992 and more significantly between 1999 and 2007. As with the UK, the increase in unemployment appears to have little impact on tourism demand in Greece with the exception of 2009, which coincided with a 21.26% reduction in arrivals from Italy. The greatest increase in tourist arrivals was associated with the longest period of sustained reduction in unemployment between 1999 and 2007. These figures are particularly important given Italy's unique status as a popular tourist destination.

France, being the fourth leading country of origin has seen unemployment levels more prevalent with significant rises in the jobless figures arising between 1978 to 1986, 1991 to 1993 and 2008 to 2009. Despite this, tourist arrivals from France appear to be relatively insensitive to increases in unemployment. Instead, tourist demand appears to coincide with sustained falls in the jobless figure. For instance, the overall decline in unemployment between 1997 and 2007 coincided with an increase of French tourist arrivals in Greece by 77.20%. It is even more surprising that during the recent financial crisis the level of unemployment increased significantly and the number of tourists increased by approximately 35%.

Turkey has implemented reforms to improve its monetary policy over the past decade. Inflation, which at its peak reached 65% during the early years of this millennium, is now under control. Economic reforms are ongoing. The government has introduced new mechanisms to manage public debt and to make its national budget more transparent. The banking system functions relatively better and the currency has been overhauled (Hoekman and Togan (2005)). However, increases in unemployment levels have been more prevalent with rises in excess of 10% per year recorded in 1986, 1999, 2001, 2002, 2008 and 2009. Despite that, arrivals from Turkey continued to increase of which as late as 2008, tourist numbers grew by 28.26%. This is attributable to a significant upward trend in employment from 5.3 million in 1982 to over 21 million by 2008 (see Appendix 1). Furthermore, hosting the Olympic Games in 2004 increased the Turkish citizens visiting Greece by 40.60%.

[Insert Table 3 About Here]

Using unemployment levels is a major innovation of the paper in understanding fluctuations in tourism arrivals. Part of the rationale behind this idea is provided by Malley and Moutos (1996) in analyzing unemployment as a measure of aggregate income uncertainty. Using quarterly data from the U.S., they find an inverse relationship between the level of consumption and unemployment that is attributable to an increase in precautionary savings during periods of high unemployment. This conclusion fits well with the validity of an inverse relationship between the level of unemployment in the local market and the level of real wages as postulated by the wage curve hypothesis (Blanchflower and Oswald (1990 and 1994), Wagner (1994), Deller and Tsai (1998), Estevao and Nargis (2002), Montuenga, Garcia and Fernandez (2003) and Galdeano and Turunen (2005)). Additionally, this is in line with the psychological impact of unemployment as having a negative impact on vocational activity and well being (Blanchflower (1996, 2001), Ahn, Garcia and Jimeno (2004)).

2. METHODOLOGY

Forecasting arrivals has traditionally involved the utilization of two competing methodologies: qualitative and quantitative. For instance, Uysal (1985) evaluated the usefulness of both types of models with the former relying on expert judgment used as inputs into models that generate forecasts, whilst the latter involves the use of structural time series models. Recent literature on forecasting tourist arrivals have used, in general, structural models in response to the growing importance of generating more accurate forecasts associated with an increasingly competitive regional and international tourism market. For instance, Chu (1998) used Sine Wave Time Series Nonlinear Regression models and various ARIMA modelling specifications to compare the performance of tourism arrivals forecasts in Asian Pacific countries.

There is another body of literature using macroeconomic inputs into structural time series models to forecast future tourist arrivals. For instance, Metzgen-Quemarez (1990) used real GDP figures from the US, amongst other factors; Var, Golam and Icoz (1990) and Icoz, Korzak and Var (1998) employed Turkish CPI figures and the TRL exchange rate against the currency units from the tourist's country of origin, respectively; Greenidge (2001), used real GDP and CPI of the country of origin as well as the price index of tourism in Barbados and finally, Song, Witt and Jensen (2010) employed GDP data of the country of origin and CPI in Hong Kong relative to the country of origin adjusted by the exchange rate.

In light of the models used by previous studies, this study employs two different approaches to predict future tourism arrivals to Greece from 2010 – 2015. The first approach used is the ARIMA model as utilised by previous studies followed by the Holt – Winter's Trend Corrected Seasonal Exponential Smoothing Model. The usefulness of both forecasting models put together has been highlighted by Chu (1998) in evaluating the accuracy of *ex post* forecasts of tourism arrivals in the Asian-Pacific region.

A third method proposed, and one that constitutes a methodological contribution, is the application of the Vector Autoregressive (VAR) Model, first introduced by Sims (1980). Since then, it has been widely used in the economics and finance literature. For instance, within the unemployment literature, the VAR has been used extensively to generate forecasts of the natural rate (Groenewold and Hagger, 2000 and King and Morley, 2007) and turning points in the rate of unemployment (Edlund and Karlsson, 2002), just to list a few. In the context of this paper, using the VAR approach opens a new dimension in understanding the relationship between changes in unemployment levels in the country of origin and future tourism demand and the extent to which random shocks impact on future arrivals.

This leads to the use of another tool that has yet to be used in the literature, namely the impulse response analysis. This provides information on how the introduction of an unemployment shock into the VAR system feeds through to future tourism arrivals. To determine the statistical reliability of the response, Monte Carlo Simulation is used to construct confidence bands around the impulse responses. This is of paramount importance to policy makers and industry, as it provides useful inferences on the sensitivity of future tourism arrivals to random macroeconomic shocks.

2.1. ARIMA Models

One of the most widely used methods of forecasting tourism arrivals is the autoregressive integrated moving average (ARIMA) model developed by Box and Jenkins (1976). Its usefulness in generating superior forecasting performance has been highlighted amongst others by Preez and Witt (2003) for tourism arrivals in the Seychelles. Chu (2009) used ARMA models to generate accurate forecasts for tourism arrivals in the Asian-Pacific region. In short, the ARIMA model is a univariate approach that uses the linear combination of its past values (p) and errors (q) to generate *ex post* forecasts of the variable. It is based on the notion that a time series is correlated with itself with a time lag and not another series. Hence, beginning with tourist arrivals denoted as *ARR*, we take the first difference of the series:

$$DLARR_t = \log\left(\frac{ARR_t}{ARR_{t-1}}\right) \tag{1}$$

where $DLARR_t$ is assumed to be stationary. Given that the objective is to forecast tourist arrivals in Greece from 2010 – 2015, the ARIMA (p, d, q) model will be used to generate ex post forecast for one to six period horizons:

$$DLARR_t = \alpha + \sum \varphi_p DLARR_{t-p} + \sum \boldsymbol{\Theta}_{\mathbf{q}} \boldsymbol{\varepsilon}_{\mathbf{t-q}} \tag{2}$$

where d = 1 for first difference in the series and p, q = 1,……,6. The φ and Θ are coefficients to be estimated and used to compute *ex post* forecasts as a linear function of past values and errors. By defining p, q = 1,……,6, the ARIMA model will be able to generate tourist demand forecasts from one to six years ahead.

2.2. Holt – Winters (H-W) Exponential Smoothing Model

The second approach used to forecast tourist rates, one to six period horizons, is the Holt-Winters trend-corrected seasonal exponential smoothing model (H-W thereafter). The usefulness of this approach has been highlighted in previous studies. For instance, Lim and McAleer (2001) use this approach to forecast tourist arrivals in Australia and find it outperformed alternative exponential smoothing model specifications including the H-W non-seasonal model over the period 1998 to 2000.

However, unlike the ARIMA model and alternative exponential smoothing models, this approach takes advantage of trends in the data and any evidence of seasonality. This model has three updating coefficients, each with a constant that is between zero and one. These coefficients use weighted moving averages of past time series values to generate out-of-sample forecasts where the greatest weight is attached to the most recent observation. The weight attached becomes smaller as observations move further into the past. To begin with, we define tourist rates (*ARR*) as governed by the following model:

$$ARR_t = \mu_t + b_t t + S_t + \varepsilon_t \tag{3}$$

where μ_t is the permanent component, b_t is the trend component and S_t represents the additive seasonal variation. From equation (3), the coefficients to be updated (μ_t, β_t and S_t) are as follows:

$$\mu_t = \alpha\left(y_t - S_t(t-s)\right) + (1-\alpha)\left(\mu_{t-1} + \beta_{t-1}\right)$$

$$b_t = \beta\left(\mu_t - \mu_{t-1}\right) + 1 - \beta b(t-1)$$

$$S_t = \gamma\left(y_t - \mu(t+1)\right) - \gamma S_t(t-s) \tag{4}$$

where $0 < \mu, \beta, \gamma < 1$ are damping factors and s is the seasonal frequency. The damping factors μ, β and γ are estimated by minimizing the sum of square errors. From equation (3), we compute *ex post* forecasts using the following model:

$$ARR_{t+i} = \mu_t + b_t t + S_{t+1-s} \tag{5}$$

where $i = 1,\ldots,6$ and the seasonal factors are utilized from the last s estimates. Similar to the ARIMA model, the *H-W* model utilizes information contained in past tourist numbers to generate *ex post* forecasts.

2.3. Vector Autoregressive Model (VAR)

The third methodology proposed in this paper requires a system of simultaneous equations where there are at least as many equations as dependent variables. The Vector Autoregressive Model, first introduced by Sims (1980), is a generalization of the univariate AR representation. To model an ***N*** variable system using a vector autoregressive model is expressed as:

$$Y_t = \sum_{s=1}^{L} \Phi_s Y_{t-n} + u_t \quad E\left(u_t, u'_t\right) = \sum \tag{6}$$

which in expandable form is equivalent to:

$$Y_t = \Phi_1 Y_{t-1} + \Phi_2 Y_{t-2}, \ldots\ldots\ldots, + \Phi_n Y_{t-n} + u_t \tag{7}$$

where Y_t is $(N \times 1)$ column vector of tourism arrivals and unemployment levels that are assumed to be stationary. The $\Phi_1, \ldots, \Phi_n$ are $(N \times N)$ parameter matrices and u_t represents a vector i.i.d process in which $\sum$ is a $(N \times N)$ matrix that shows the variance and contemporaneous co-variances for individual elements of u_t. Φ_n is a measurement of the impact that a change in unemployment levels on the previous period would have on the current tourism arrivals in *n* periods and *vice versa*. Therefore, it is hypothesized by the wage curve theorem that the coefficient Φ_n should be significant and negative to imply an inverse relationship between tourism arrivals and changes in unemployment. Assuming that the process is stationary, the VAR model of equation (7) can be expressed in terms of a moving average representation as:

$$Y_t = E(Y) + \sum_{n=0}^{\infty} A_n u_{t-n} \tag{8}$$

where $E(Y)$ is a $(N \times 1)$ vector representing tourism arrivals of the previous period as a linear projection of past variables in the system and u_{t-n} is a $(N \times 1)$ vector that represents unexpected changes in tourism demand at time *t-n*. A_n measures how the system responds to a random shock in unemployment from the country of origin in the previous period.

$$A_n = \frac{\partial Y_{t+n}}{\partial u_t} \tag{9}$$

Simulating requires setting $u_{i,t} = 1$ along with other u_t's as well as $Y_{t-1} = Y_{t-2} = \ldots = Y_{t-n} = 0$. This is repeated for *i* = 1,.....,*s* to obtain realizations of the A matrix for *n* periods. It is this process that defines the impulse response function to be discussed next.

2.3.1. Impulse Response Analysis

The impulse response function is a valuable tool in isolating the effect on future tourism demand to a shock in unemployment from the country of origin, assuming other variables are held constant. For the purpose of this study, we consider a simple VAR model consisting of tourism demand and unemployment changes in the country of origin at time *t*, denoted as $Y_{i,t}$ and $X_{j,t}$, respectively:

$$\begin{aligned} Y_{i,t} &= \eta_1 + \Phi_1 Y_{i,t-n} + \Phi_2 X_{j,t-n} + u_{i,t} \\ X_{j,t} &= \eta_2 + \Phi_1 X_{j,t-n} + \Phi_2 Y_{i,t-n} + u_{j,t} \end{aligned} \tag{10}$$

The model of equation (10) is a VAR(*n*) specification given that the variables in the system have a lag of *n*. A change in the innovation $u_{i,t}$ will immediately change tourism demand $Y_{i,t}$. It will also change all future values of Y and X, since lagged Y appears in both equations. Assuming that the innovations $u_{i,t}$ and $u_{j,t}$ are uncorrelated, the interpretation of the impulse response is straightforward. The $u_{i,t}$ is the innovation for Y and $u_{j,t}$ is the innovation for X.

The impulse response functions for $u_{j,t}$ measures the impact of a random shock on current unemployment levels and future tourism demand.

The innovations $u_{i,t}$ and $u_{j,t}$ are, however, usually correlated, so that they have a common component that cannot be associated with a specific variable. A common, but arbitrary method of dealing with this issue is to attribute the full impact of any common component to the variable that comes first in the VAR system. In this case, the common component of $u_{i,t}$ and $u_{j,t}$ is $u_{i,t}$ given that the innovation $u_{i,t}$ precedes $u_{j,t}$. Hence, $u_{i,t}$ becomes the Y and X innovation, which are transformed to remove the common component. We transform the innovations by orthogonalising the errors using the Choleski factorisation. This is a popular method of transforming the covariance matrix of the resulting innovations in the VAR residuals into a vector of orthogonal innovations defined as e_t.

$$E\left(e_{i,t}e_{j,t}\right) = 0 \qquad \text{where} \quad i \neq j \tag{11}$$

To transform the error terms, a $\left(N \times N\right)$ lower matrix defined as V is chosen and the orthogonalised innovations e_t are obtained to satisfy the following equation:

$$e = uV^{-1} \tag{12}$$

where the innovation u_t has an identity covariance matrix such that:

$$Eee^T = \Omega \tag{13}$$

and

$$VV^T = \Omega \tag{14}$$

Upon making the transformation of the orthogonalised innovation and replacing the u_t with e_tV, equation (8) can be rewritten as follows:

$$Y_t = \sum_{n=0}^{\infty} A_n V e_{t-n} \tag{15}$$

which omits the mean term $E\left(Y\right)$ of equation (8) given that it is of no importance to the simulation process. By defining $B_n = A_n V$, equation (16) becomes:

$$Y_t = \sum_{n=0}^{\infty} B_n e_{t-n} \tag{16}$$

where B_n represents the impulse response of the market in the future to a shock of one standard deviation in time *t*. Hence, the elements of B_n are said to be *impact multipliers*. Assuming the vector Y of tourism arrivals is stationary, the impulse response should tend towards zero as *n* becomes large.

3. EMPIRICAL RESULTS

3.1. Model Forecasts – The ARIMA Model

Table 4, Panel A, presents the *ex post* forecasts from 2010 – 2015 on tourist arrivals using the ARIMA and H – W models. Panel A presents the results using the ARIMA (*p,d,q*) model where *d* =1 and *p, q* = 1,…..,6 (Coefficient values are not reported for brevity but are available upon request). It also reports forecasts on the percentage change relative to the 2009 figures for the same horizon. As a preliminary back-test on the model's ability to capture long term trends in the data, all tables report correlation values defined in terms of the relation between the percentage change forecasted from one to six year horizons and the percentage change in actual tourist numbers. The back-test is run from 1988 to 2009. The results clearly reflect that forecasted tourist arrivals for a number of the Islands (Corfu, Crete and Samos) are projected to increase between 2010 and 2015 from 2009 levels in line with historical trends going back to 1977 (see table 1).

However, in most cases, the projected numbers are forecast to decline over the six year horizon and in some instances to be down by 2015 based on the 2009 figure (Rhodes, Santorini, Mykonos, Zante and Skiathos). Athens, being a non-summer holiday destination, is forecast to see a major increase in 2012 and only to fall quite dramatically from 2013 onwards. Correlation statistics show that model performance in capturing historic trends varies quite widely with the most consistent performer being Kos and Thessaloniki over one to six period horizons whilst the least consistent is Kefalonia, Skiathos and Zante. Model performance shows improvement in later years for Athens, Rhodes and Kos whereas deterioration in the forecastability of the ARIMA model is reported for Santorini, Mykonos and Crete.

3.2. Model Forecasts –The Holt – Winters (H – W) Exponential Model

Panel B of Table 4 presents *ex post* results using the H – W Exponential Smoothing Model approach. In the vast majority of cases, with the exception of Zante and Samos, the H – W approach forecasts an increase in tourist numbers over the six year horizon from the 2009 figure. These projections are consistent with historical trends dating back to 1977 (see table 1) and are in marked contrast to the findings of the ARIMA model. Only Rhodes, Corfu and Crete produce robust forecasts of increases in tourist numbers on 2009 levels using both approaches. Correlation analysis indicates that the H – W approach outperforms the ARIMA model in capturing the long term trends. In all cases, the performance of the H – W model in predicting tourist numbers shows a marked improvement in capturing longer term trends with directional accuracy being highest for 2015 forecasts.

[Insert Table 4 About Here]

3.3. Back-Testing Forecasting Performance

To provide further intuition behind the preliminary test results, Table 5 reports the findings of further back-tests on the forecast ability of all techniques using *ex post* forecasts one to six year horizons. Panel A presents the results for the ARIMA Model and Panel B for the Holt-Winter's Exponential Smoothing Model. The "Dir Up" and "Dir Down" report the success rates of models in capturing the direction of the *ex post* up and down forecasts, respectively. To establish how these results translate into forecasting accuracy of tourist numbers, a second back-test is proposed that tests the forecast accuracy of both approaches. The forecast ability of both model types are tested by the Mean Squared Error (MSE) and frequently used Root Mean Squared Error (RMSE) measures (Preez and Witt, 2003 followed by Chu, 2009 to list a few). These statistics are computed on the basis of the following equations:

$$MSE = \sum_{j=0}^{T-1}\left[\frac{[F_t - A_t]^2}{T}\right] \tag{17}$$

$$RMSE = \sqrt{\sum_{j=0}^{T-1}\left[\frac{[F_t - A_t]^2}{T}\right]} \tag{18}$$

where F_t is the *ex post* forecast one year to six year horizons, A_t is the actual tourist number known for each corresponding year and T is the total number of forecasts. Focusing on the directional forecast success rates, Panel A of Table 5 shows that the ARIMA model is performing quite well when the model forecasts an increase in tourist numbers from one to six year horizons. This is broadly the case for Athens and all islands. However, the ARIMA model performs poorly when it forecasts a fall in numbers. This implies that one should place extreme caution on the reliability of the model's forecasts when it predicts a fall in tourist arrivals. Furthermore, the directional forecasting performance of the ARIMA model explains the poor correlation statistics reported in the preliminary back-tests in Table 4, Panel A. Using equations (17) and (18) to determine the accuracy of point forecasts reveal consistencies in the poor performance of the ARIMA model as forecasting tool.

Panel B of Table 5 reports the results for the H–W model. Consistent with earlier findings reported in this paper, the H–W approach outperforms the ARIMA model, especially when it forecasts a fall in tourist numbers. It also outperforms the ARIMA in terms of the accuracy of point forecasts from one to six year horizons. This also implies that the high directional success rate of the model does translate into point forecast accuracy at all horizons with the exception of Thessaloniki, Skiathos and Kefalonia for forecasting horizons five and six. Once again, this is consistent with earlier findings that the H–W approach captures the longer term historical trends reported in Table 1.

[Insert Table 5 About Here]

3.4. The Impact of Unemployment on Tourism Arrivals

3.4.1. The VAR Model Results

In light of the results presented so far, it is of paramount importance to understand the dynamics that govern the fluctuations of tourism arrivals. To do so, it is essential to identify the potential source of risk that could adversely impact on future arrivals. Hence, we utilize the VAR(n) model on monthly data of tourist arrivals and unemployment levels from the countries of origin. As mentioned earlier, monthly data from 1977 to 2009 provides enough observations to implement the VAR model and also allows for impulse response analysis on the effect of random shocks on future tourism arrivals. Given that VAR models are modelled on a stationary time series, the first step requires the implementation of unit root tests on each series. Instead of using the Augmented Dickey-Fuller (ADF) test, we employ the Phillips-Perron (PP) approach on the log series, first followed by the transformed series.

The intuition behind the use of the PP is that it has more power than the ADF test. One issue that arises with the ADF is the selection of the number of lags that could lead to a bias towards rejection of the null hypothesis of a unit root in the event of selecting too few lags. Conversely, bias towards accepting the null hypothesis tends to arise in the event of selecting too many lags. This problem is overcome by the PP approach, as it applies a non-parametric correction to deal with any serial dependencies in the dataset. Hence, the PP test is applied on each data series to test the null hypothesis that $\delta_1 = 0$ against the alternative that each series follows a stationary process using the following:

$$\Delta y_t = \beta_0 + \beta_1 (t - T/2) + \delta_1 y_{t-1} + \varepsilon_t \tag{19}$$

where y_t represents tourism arrivals and unemployment series and $(t - T/2)$ denotes the time trend. Table 6 presents the PP test results for each series. Interestingly, the null hypothesis of a unit root in the series is overwhelmingly rejected for tourist arrivals using the levels, whereas for unemployment data, rejection of the null hypothesis only arises in the transformed series, i.e., at the first difference.

[Insert Table 6 About Here]

The unit root test results have major implications on the VAR model specification used given that it is modelled in stationary data. As a result, we start with the estimated specification of equation (10) in its compact form:

$$\begin{aligned} LARR_t &= c_1 + \sum_{i=n} b_i LARR_{t-i} + \sum_{i=n} b_i \Delta LU_{t-i} + u_{i,t} \\ \Delta LU_t &= c_2 + \sum_{j=n} b_j \Delta LU_{t-j} + \sum_{j=n} b_j LARR_{t-j} + u_{j,t} \end{aligned} \tag{20}$$

where $LARR$ is the natural logarithm in tourism arrivals for each destination and ΔLU denotes the change in unemployment levels for the UK, US, Japan, France, Germany, Italy, the Netherlands and Turkey. Before estimating equation (19), we performed the Schwartz Information Criterion test to determine the optimal number of lags (n) used in each model system. The model specifications of equation (19) are summarised in Appendix 2. Table 7 presents the VAR estimations for each destination which includes t-statistics in parenthesis.

Due to the volume of model output this VAR system provides, we only report the model coefficients that are statistically significant at the five per cent level and limit results for each tourist destination. In brief, the results suggest a greater tendency of an inverse relationship between changes in unemployment and tourism arrivals for all destinations, a finding that sheds some light on the validity of the wage curve hypothesis. The evidence in favour of the wage curve hypothesis and the psychological impact of unemployment is greatest on tourist arrivals to Thessaloniki and Kefalonia, followed by Corfu and Crete.

[Insert Table 7 About Here]

3.4.2. Impulse Response Results

A shortcoming with the VAR system just estimated is that it is difficult to interpret on its own due to complications arising from cross correlation feedbacks along with the fluctuation of estimated coefficients on successive lags. As a result, it is misleading to employ the common practice of inferring the long run equilibrium behaviour by summarising the distributed lag relations. An alternative and more useful approach is to consider the system's response to random shocks originating from unemployment surprises and the extent to which these shocks continue to have an impact on future tourism arrivals. In undertaking such an exercise, we could identify the potential source of risk to future tourism arrivals. To this effect, impulse responses take into account the variations in the velocity to which the effects of unemployment shocks are transmitted, as well as the duration and rate of decay.

In order to determine the robustness and reliability of the response, we compute confidence bands using Monte Carlo Simulation that is simulated 5000 times as a robustness test of the impulse response. Large confidence intervals around the impulse response call into question the credibility of the measurement information, and as such, the robustness of the response. Appendix 3 displays time paths of impulse responses on future arrivals in each destination to a one standard deviation unemployment shock in the country of origin. To ensure consistency with the annual forecasts reported earlier, we generate impulse responses in future tourism arrivals 72 months ahead, which is equivalent to the six year horizon of 2010 to 2015.

The results provide a clear picture on the impact of unemployment shocks on future numbers in the top destinations. There is some evidence that a random shock from the country of origin has an immediate impact on future tourism arrivals that is associated with a high velocity and a rapid rate of decay, although the duration varies across destinations. The impulse response results reveal France as being a consistent source of risk to future arrivals to all destinations in terms of the magnitude, and to some extent, persistence. However, the duration and rate of decay does vary from destination to destination. This is followed by unemployment shocks from Germany and, to a lesser extent, the Netherlands. The findings also identify future arrivals to Kos, Santorini and Mykonos as being most at risk, as a result of unemployment shocks, mostly from Japan, France, Germany, the Netherlands and Italy.

Despite this, the magnitude of the response, velocity and rate of decay varies among destinations. Within that subset of countries, there is some evidence that the impulse response becomes statistically significant after a delay. Despite this, in all cases, the impact of the shock on future arrivals appears to be temporary. Interestingly, future tourist arrivals seem to be least responsive to shocks originating from the U.K., the U.S. and Turkey for all destinations. As such, this is consistent with the earlier analysis from Tables 2 and 3 on annual tourist arrivals and unemployment levels. However, one should question the robustness of the response of future arrivals to Corfu and Kos due to a widening of the confidence bands at the time of the random shock from the U.K and U.S. After weighing up the results, our findings cast doubt on the wage curve hypothesis as a plausible explanation behind the relationship between unemployment and tourism arrivals.

4. FURTHER DISCUSSION OF THE RESULTS

Taking the empirical results together, the H – W exponential smoothing model is a better forecasting tool than the ARIMA model. This contrasts with the early findings of Chu (1998), followed by Preez and Witt (2003), in which the superior performance of the ARIMA model in relation to other approaches was highlighted. The increase in tourism arrivals forecasted by the H – W approach is not surprising given historical trends in the data dating back to 1977. Finding differences in the direction of arrivals forecasts and model performance using both approaches is also not surprising. For instance, Clements and Hendry (1998) argue that the performance of econometric models is determined by the methodology used to generate forecasts. Furthermore, Song, Witt and Jensen (2003) argue that the structure of econometric models, regardless of methodology, is based on the assumption that the parameters remain constant throughout the entire sample period. Although this could be addressed by running all models in a rolling window, this is not feasible here due to restrictions in the availability of data.

In the absence of robust model forecasts across methodologies, investigating the impact of unemployment shocks in the country of origin takes on added importance, as impulse responses could provide some intuition behind fluctuations in future tourism arrivals. Slower rate of decay and velocity in the impulse responses implies a persisting effect of a random shock on future arrivals that it appears to be consistent with the inconclusive forecasts generated by the ARIMA model of Table 4, Panel A. The temporary response, following the introduction of a shock, is conversely consistent with the forecasts generated by the H – W approach that, in general, represents a continuation of past trends in future arrivals.

An added dimension is provided by determining whether the implications of the wage curve hypothesis are consistent with the VAR results and impulse response analysis. Our findings are mixed after combining both sets of results. Based on the VAR(*n*) results, a greater tendency to report a statistically negative relationship between changes in unemployment and tourism arrivals is in tune with the wage curve hypothesis. By adding the overall conclusion of Malley and Moutos (1996), in which periods of high unemployment are associated with increases in precautionary savings, it is plausible to assert that it would have a negative impact on future tourist arrivals. Furthermore, the negative relationships reported in VAR models are consistent with studies reporting unemployment as having a negative impact on the level of well being and happiness (Blanchflower (1996, 2001) and Ahn, Garcia and Jimeno (2004) with the latter study finding a significant reduction in vocational activity).

However, one issue with the VAR system estimated earlier relates to the difficulties in interpreting the coefficients owing to complications arising from correlation feedbacks in addition to fluctuations of estimations at different lags. As a result, suggesting that our findings are consistent with the overall unemployment literature may be misleading. Further doubts on the wage curve hypothesis arise after performing the impulse response analysis as we find the impact of surprises on future arrivals is temporary with the exception, to some extent, of shocks originating from France. Overall, our analysis opens an added dimension on the importance of unemployment shocks in providing a clearer picture on future arrivals for policymakers and the industry to use as part of their decision making process. Furthermore, our results highlight the need for third parties to perform impulse response analysis on each destination as the size of the response, the rate of decay and velocity, as well as the duration of the response, varies considerably.

5. IMPLICATIONS ON TOURIST ARRIVALS AND THE EFFECT OF UNEMPLOYMENT

The above analysis has a number of implications. The impulse response results clearly show the source of potential risk to future arrivals as a result of unemployment shocks from the country of origin. With the source of this risk mainly confined to countries in the European Union, the results suggest that the Greek authorities should focus more on attracting a greater number of tourists from countries outside the E.U. such as China, India, Russia and, even, the U.S. For instance, indications on arrivals from China are very positive as over the studied period there is an average annual growth rate of 19.22%. Chinese tourists consider Greece as one of the most popular destinations for honeymoon and especially the Island of Santorini.

The Greek authorities should build on this source of tourism to encourage Chinese people to visit Greece as one of their favorite destinations. The strong historic links between the two countries and the excellent diplomatic relations at the highest level can be the basis on which this relationship can be based. It is worth noting that the last two Chinese Presidents visited Greece and combined their official duties with short vacations in Crete. In sum, the impulse response results imply that investment in promoting Greece as a favored destination to countries outside the E.U. could help diversify away potential risks resulting from unemployment shocks from the countries of origin. This suggestion becomes more poignant given that the tourist industry in Greece could in effect diversify away economic risks from the county of origin on future tourist numbers.

Very importantly, we should note the strength of the Turkish market given that it is one of the largest countries in the area and has cross border links with Greece. According to impulse responses performed on all destinations, future tourist arrivals appear to be insensitive to unemployment shocks from Turkey. The average annual growth rate has been as high as 11.48%. Especially in 2008, when the new motorway ‘Egnatia Odos’ went public in the Northern part of Greece, the arrival of Turkish tourists rose by 28.26%. Currently, there are inconvenient connections between the Turkish main airports and the Greek islands. It is projected that Turkish figures will be doubled when this is sorted out.

In addition, promoting off-season travel as part of the tourism strategy is crucial given that Greek tourism industry suffers from marked differences between the high and low seasons. In particular, during the winter, hotel vacancy rates drop dramatically (especially in the Greek islands) to an average of 27% (compared to 90% in August). To address this long-standing problem, in 2008, a new advertising campaign – ‘The True Experience’ – has come to promote Greece as a year-round destination, highlighting lesser-known regions and tourist attractions to augment the traditional images of sun, sea and sand. The Ministry of Tourism, along with its industry partners are targeting niche markets (ecotourism, adventure holidays, spa holidays and culture tours) as well as meetings, incentives, conferences and exhibitions (MICE) markets to better distribute the flow of tourists throughout the year.

As part of the overall strategy in targeting niche tourists, the Greek travel suppliers and tourist operators need to apply more effective marketing through the new media in E.U. countries and beyond. Modern tourists, whose number has increased dramatically over recent years, conduct most of their research via the Internet rather than opting for a tour package. Modern tourists include middle class earners, university students, recently employed graduates, middle-aged low salaried people and retired people who aim for ‘value for money’ holidays.

The traditional Greek ‘brand’, based on the promotion of natural beauties of Greece, has been successful over many years. However, it needs modernization to reflect new circumstances arising from rising global unemployment trends and increased competition. One way of modernizing the brand is to change its image and promote city breaks (for instance, Thessaloniki as well as Athens) in addition to maintaining its traditional brand. Many South-Eurasian countries such as Cyprus, Croatia and Turkey all have sunny climates and similar tourist attractions (archaeological sites, great beaches and cultural events), but offer, in most cases, less expensive tourist products than Greece. Hence, Greece should be able to promote its comparative advantage, such as the existence of the many Greek islands which offer unique destinations to touristss.

Increased spending by tourists can be achieved by increasing the quality of existing products as well as expanding its range. In addition, as part of re-branding Greece as a holiday destination it can be enhanced by promoting other parts of the country as part of a strategy of boosting spending by tourists. For instance, Western Greece is virtually unknown territory to all but the most adventurous tourists. Additionally, expanding the tourism season beyond the summer could also pay dividends.

Tourist arrivals could also be increased through co-operation between the Greek authorities and other countries of the European Union through special travel packages for unemployed E.U. citizens during the winter. Such a decision will enhance countries' social profile and increase the hotels' coverage during off-peak tourist periods in Greece, boosting tourism employment and bringing many people back to work. Also, very importantly, it would act favorably in the psychology of the E.U. residents. Finally, it would come as a supplement to the efforts that have already been made by the Greek Ministry of Culture and Tourism, which urges tourists and retirees to visit Greece during off-season periods by covering part of the hotel expenses. Finally, Greek authorities need to implement structural reforms to overcome long-standing problems of bureaucracy, inadequate tourism training and uneven standards of customer service across the country. These are issues that have yet to be resolved in order to improve the reputation of Greek tourism.

As a result of the impact of unemployment shocks in the countries of origin, a potential source of risk to future tourism arrivals has been identified by our findings. Safeguarding the Greek tourism industry requires investment on the brand itself in addition to promoting Greece to countries beyond the E.U. as a means of diversifying away global economic risk. The results in this paper should provide inferences on where to target future additional investment in promoting the brand to new countries and/or regions in addition to its traditional sources of tourism.

6. CONCLUSION

In this study we forecasted tourist arrivals in the most popular destinations of Greece from 2010 to 2015 and investigated whether unemployment surprises from the country of origin had an impact on future arrivals. Our comprehensive analysis of forecasting tourism arrivals addressed a major gap in the literature given that Greece, being a "hot" destination for tourists, had up to now not been investigated by previous studies. Hence, we offered important insights into the arrivals in the two biggest cities (Athens and Thessaloniki), the two biggest islands

(Crete and Rhodes), the three famous Ionian islands (Corfu, Zante and Kefalonia) and two “hot” destinations, particularly in the recent years, Mykonos and Santorini. We employed two forecasting models: the ARIMA and the Holt-Winters (H-W) trend-corrected seasonal exponential smoothing models that use information contained in past tourist numbers to generate *ex post* forecasts.

Our results were mixed. In particular, according to the H-W exponential smoothing seasonal models, tourism in general is forecasted to have an upward trend between 2010 and 2015, a finding that is consistent with the historical trends dating back to 1977. This differed somewhat with the ARIMA model, in which only three cases (Rhodes, Corfu and Crete) did we find directional forecasts robust using both approaches. Contrary to the findings of previous studies, our results showed that the ARIMA model performed relatively worse than the H–W exponential models in terms of capturing the long term trend in tourist arrivals and the accuracy of the forecasts.

Another major contribution of this study is that it investigated the impact of unemployment shocks from the country of origin using impulse response analysis simulated from a VAR system of equations. The intuition here was to identify the potential source of risk to future tourism numbers as a result of unemployment shocks. To undertake this analysis we introduced a one standard deviation unemployment shock into the VAR system to gauge the impulse response on future arrivals over the next 72 months (i.e., six years). According to the impulse responses, our findings identified the main source of risk to future arrivals as being an unemployment shock from France. This finding was robust across all destinations although the magnitude, duration and rate of decay varied. This was followed by unemployment shocks from Germany and to a lesser extent the Netherlands.

The findings also identified future arrivals to Kos, Santorini and Mykonos as being most at risk as a result of unemployment shocks. Interestingly, future tourist arrivals appeared to be least responsive to shocks originating from the U.K., the U.S. and Turkey for all destinations. After weighing up the results, our findings cast doubt on the wage curve hypothesis as a plausible explanation behind the relationship between unemployment and tourism arrivals. However, question marks are raised on the reliability of the impulse response especially for shocks originating in the U.K. and U.S. due to wide confidence bands at the time of the surprise. The impulse response results open a new dimension not considered before, not only due to the use of unemployment data but also due to the methodological contribution that allows one to investigate the impact of unemployment surprises. As a result, our comprehensive evidence offers important implications and insights to policymakers and tourist operators regarding the tourism demand in Greece.

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Table 1. Tourist Arrivals in the Major Greek Destinations (Athens – Thessaloniki and the Most Popular Greek Islands)

	Total	Athens	Rhodes	Corfu	Crete	Thessaloniki	Kos	Santorini	Mykonos	Zante	Skiathos	Kefalonia	Samos
1977	3961112	1620953	348516	276476	270421	502467	47318	1541					
1978	4532411	1768681	410223	306351	312308	577821	57576	1607					
1979	5798360	2242349	470783	337911	324539	783750	59395	1828	-	-	-	-	-
1980	5271115	1824349	477083	367911	386469	695256	66960	2451	-	-	-	-	-
1981	5577109	1890864	503599	405923	453943	725948	86639	3060	-	-	716	86639	-
1982	5463860	1792311	502684	406938	489793	656495	147763	9958	7370	7092	2441	10283	66389
1983	5258372	1795242	483637	377385	490849	412268	137731	12581	11462	21660	17492	8849	71429
1984	6027266	2091668	548634	408045	615146	575000	159993	11170	16966	22212	25180	11127	78439
1985	7039428	2256309	645879	529684	780674	727000	232340	22926	22401	39137	34997	24906	93584
1986	7339015	2106636	702212	604227	823349	757839	255094	31849	31209	61732	62153	38846	101000
1987	8053052	2489968	752138	723346	857444	792847	311024	32894	27697	61940	79638	79638	111579
1988	8351182	1983496	784583	635592	949477	812458	314575	37534	26446	118109	72979	50618	126545
1989	8540962	1760968	724646	555077	1020403	832529	316398	35857	15583	109086	63375	46751	116878
1990	9310492	1971935	787117	611721	1126350	856439	340482	16570	24856	132567	49712	49712	91139
1991	8271258	1837573	711061	641200	1276142	852920	345775	47936	39947	167778	79894	47936	87883
1992	9765012	2233828	921454	737936	1628085	866439	435703	65153	46538	204767	102383	74467	120999
1993	9913267	2241377	907665	728769	1662745	892650	455573	74095	46309	185237	111142	83356	138928
1994	11230854	2577211	1043664	773544	2032070	907442	568140	117145	53248	244941	138445	106496	149744
1995	10712145	2353579	903006	751056	1811308	832758	505998	105670	48032	220948	124883	96064	144096
1996	9782061	2303258	1014082	671694	1842391	788761	473915	122522	56879	245367	97220	86176	140561
1997	10588489	2129258	1095271	725306	2026224	1050656	530294	129534	47454	275203	94850	71448	137458
1998	11363822	2307635	1177240	901123	2186631	881518	585907	144882	82249	325009	111943	88814	147489
1999	12605928	2469032	1403361	943485	2495220	808600	653572	178065	81437	388050	120054	120411	159487
2000	13567453	2802397	1432423	1015553	2523597	942275	682650	184871	101751	437761	129051	137468	147191
2001	14678688	2977658	1393228	1019586	2570072	1003325	711990	186684	100221	470589	151964	157768	149088
2002	14918177	3075215	1267375	989838	2504806	1034992	603857	132360	90307	467411	123427	143936	123636
2003	14784560	3034913	1265948	919059	2514057	1085938	588954	134507	99696	455984	143234	168684	76103
2004	14267420	3150467	1150716	826266	2247791	1103006	588854	142001	86485	454858	119085	150412	117377
2005	16938131	3541832	1297683	891284	2494475	1274701	597172	162957	99972	466441	114039	143896	117717
2006	17283910	3698953	1380361	940486	2734920	1272311	649526	178027	99960	466821	116068	160902	128888
2007	17165265	3872156	1513892	983344	2765654	1357511	681313	192018	103086	475146	120163	158729	133290
2008	16938806	3472845	1369406	898979	2804320	1635998	671660	162941	106109	464874	118438	164938	139437
2009	15914534	3170478	1321806	808098	2554905	1507081	627533	151367	111837	435874	115986	169387	141938

Table 2. Origin of Tourist Arrivals in Greece

Panel A: Tourist Arrivals in Greece by Continents

	Total	Europe	EU	Asia	Africa	America	Oceania
1977	4461084	2876637	-	210253	100136	685555	72641
1978	5081033	3367239	-	281789	126518	634078	107861
1979	5798360	3753184	-	440911	92202	764195	161569
1980	5271115	3834289	-	300761	106667	410676	132373
1981	5577109	4139498	-	305826	91848	436907	112051
1982	5463860	4115356	-	288194	87966	438432	94131
1983	5258372	3733939	-	325415	96219	517473	94998
1984	6027266	4402819	-	298739	101274	600185	110608
1985	7039428	5400558	-	294705	114139	619479	136878
1986	7339015	6186852	4448827	291066	85433	321455	132388
1987	8053052	6874703	5312997	258058	80844	317698	105876
1988	8351182	7055035	5383632	267893	90267	383339	113764
1989	8540962	7153137	5445669	297142	80531	399802	127243
1990	9310492	7992715	5957426	275142	67056	382623	114090
1991	8271258	7356995	5230906	218618	51495	255770	75055
1992	9765012	8419663	6521010	304626	51129	378191	77693
1993	9913267	8470616	6632075	370171	48538	343344	62994
1994	11230854	9640242	8255111	391383	43244	364062	68824
1995	10712145	9100237	7753231	386968	48686	323780	60066
1996	9782061	8341759	6592701	490299	43571	298144	59523
1997	10588489	9146321	6843216	517307	42435	314057	50205
1998	11363822	10047311	7663483	458566	38738	291507	52924
1999	12605928	11180627	8789371	573662	48040	305261	56498
2000	13567453	12080211	9219271	586569	60955	300213	67597
2001	14678688	13088224	9817550	607640	58105	231675	71688
2002	14918177	13236510	9637540	609509	52800	217369	63811
2003	14784560	13072924	9324485	574896	44192	219391	57990
2004	14267420	12470379	9382415	488366	49165	236274	68445
2005	16938131	13682537	10037285	521990	54686	416746	89504
2006	17283910	14748309	10579368	564529	67365	513402	109611
2007	17165265	14731798	12700368	529940	61130	579607	102973
2008	16938806	14474979	11815256	545328	58125	632948	159921
2009	15914534	13601417	10887535	533210	38186	729446	161512

Panel B: Tourist Arrivals in Greece by Countries of Origin								
	France	**Germany**	**UK**	**Italy**	**Netherlands**	**Japan**	**US**	**Turkey**
1977	276468	489522	384076	164631	106448	46241	598470	42551
1978	347627	520547	514485	214678	122054	61451	513181	49761
1979	319483	555171	559657	264646	141089	129650	601456	98197
1980	299791	692961	768215	197006	179842	75666	288647	47590
1981	298499	625121	964707	225479	170002	75154	321081	38979
1982	335366	606046	1022692	223922	139286	74802	333080	37972
1983	299506	728478	888991	327610	153672	82029	406887	43427
1984	405907	864000	1043363	328598	192879	86476	474845	42751
1985	441141	1050000	1329259	364177	280309	92802	466155	24262
1986	462898	1148728	1354742	377873	302850	85075	483620	48977
1987	471113	1302781	1412474	393117	336890	81856	514835	39837
1988	476631	1367348	1435855	414843	348002	91822	274720	45432
1989	480983	1438592	1449347	421929	356219	103926	278856	43683
1990	487290	1564289	1500428	447192	374413	107694	273849	43406
1991	485627	1544312	1503271	445720	369418	57902	180429	53531
1992	494572	1674200	1583508	457134	396010	109680	278941	73650
1993	491567	1604829	1599478	461849	407720	89907	256719	149390
1994	502837	1785401	1673820	485303	442260	95367	270777	73521
1995	484621	1830378	1704620	497837	466276	89457	239684	49018
1996	462732	1907863	1687999	491081	452179	87135	222130	47416
1997	426678	1994670	1711942	533303	464144	85029	240555	44741
1998	486201	2136515	2044243	659688	548339	87130	219362	69875
1999	545981	2450137	2433033	745915	616807	83971	229314	80502
2000	602353	2395185	2772256	823245	655285	78410	218731	133954
2001	726816	2345440	2932342	889925	715926	73350	164689	114354
2002	735568	2510849	2858360	805008	721413	69719	146754	139018
2003	714821	2267063	3008382	865730	635882	55917	148751	143536
2004	621407	2189222	2869737	898208	611990	55838	161398	201816
2005	676658	2241942	2718721	1128506	666287	45609	305840	181308
2006	712131	2267961	2615836	1187598	782154	50525	358624	180775
2007	756105	2264332	2508651	1157081	828185	57650	380611	161858
2008	910023	2469152	2554943	1099981	756939	61478	404384	207608
2009	962433	2364488	2112151	935009	651437	66345	531276	200348

Table 3. Unemployment Figures of Countries with Tourist Arrivals in Greece

Panel A: Unemployment Figures by Country

Year	UK	US	Japan	France	Germany	Italy	Netherlands	Turkey
1977	1181.5	6967	788	1109.5	1030.08	1545	208.589	1593.918
1978	1083.8	6187	906	1269.1	989.42	1614	205.522	1625.14
1979	1044.1	6135	781	1402.7	870.42	1677	198.364	1440.718
1980	1777.4	7671	750	1557.7	899.5	1699	221.881	1360.815
1981	2373.3	8276	887	1921.1	1296.08	1932	324.131	1206.82
1982	2673.7	10715	1009	2056.1	1854.75	1941	478.528	1199.581
1983	2813.7	10694	1198	2161	2263.5	2216	625.767	1333.438
1984	2955.7	8529	1211	2456.7	2264.67	2281	604.295	1334.871
1985	3033.4	8313	1162	2448.9	2305	2473	522.495	1272.738
1986	3021.4	8245	1287	2591.9	2222.58	2746	484.663	1439.302
1987	2535.8	7414	1295	2586.9	2232.58	2908	466.258	1551.705
1988	2005.8	6697	994	2558.7	2236.67	2868	462.608	1593.282
1989	1629.5	6524	800	2508.6	2032.17	2804	416.074	1662.4
1990	1846.5	7061	698	2537.1	2056.42	2736	365.889	1575.884
1991	2535.9	8640	731	2716	2616.33	2664	341.253	1680.297
1992	2960.3	9611	867	2832.3	2993.5	2062	343.078	1755.931
1993	2764.8	8927	1183	3078.4	3442.75	2355	424.286	1760.487
1994	2407.4	7976	1465	3053.6	3692.58	2499	496.368	1820.036
1995	2221.8	7407	1624	2995.5	3621.67	2535	477.207	1667.649
1996	1872.1	7231	1719	3093.4	3979.92	2573	449.834	1491.75
1997	1410.5	6729	1744	3135.6	4400	2599	391.254	1535.514
1998	1314.3	6204	2295	3079.3	4267.16	2649	312.053	1588.852
1999	1159.3	5879	2682	2825.4	4094.17	2499	262.701	1794.319
2000	1029.9	5685	2612	2447.3	3879.83	2278	200.132	1488.488
2001	966.5	6830	2800	2481	3859	2113	186	1908.507
2002	935.2	8375	2990	2589.8	4072.42	2060	231	2376.645
2003	906	8770	2834	2720.4	4380.58	2005	311.25	2397.476
2004	826.1	8140	2372	2706.2	4387.58	1934	387.25	2384
2005	908.1	7579	2118	2566.1	4860.91	1848	402.25	2388
2006	939.9	6993	1890	2268	4487.25	1581	335.5	2328
2007	815.2	7079	1763	2025.4	3776.67	1567	277.75	2376
2008	1183.5	8967	1971	2227.6	3267.83	1742	243.25	2611
2009	1600.6	14325	2833	2645.1	3423.33	2049	303.75	3471

Note: The unemployment figures are expressed in thousands (000's) and they are downloaded from Datastream.

Panel B: Percentage Changes in Unemployment

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Year	UK	US	Japan	France	Germany	Italy	Netherlands	Turkey
1977								
1978	-8%	-11%	15%	14%	-4%	4%	-1%	2%
1979	-4%	-1%	-14%	11%	-12%	4%	-3%	-11%
1980	70%	25%	-4%	11%	3%	1%	12%	-6%
1981	34%	8%	18%	23%	44%	14%	46%	-11%
1982	13%	29%	14%	7%	43%	0%	48%	-1%
1983	5%	0%	19%	5%	22%	14%	31%	11%
1984	5%	-20%	1%	14%	0%	3%	-3%	0%
1985	3%	-3%	-4%	0%	2%	8%	-14%	-5%
1986	0%	-1%	11%	6%	-4%	11%	-7%	13%
1987	-16%	-10%	1%	0%	0%	6%	-4%	8%
1988	-21%	-10%	-23%	-1%	0%	-1%	-1%	3%
1989	-19%	-3%	-20%	-2%	-9%	-2%	-10%	4%
1990	13%	8%	-13%	1%	1%	-2%	-12%	-5%
1991	37%	22%	5%	7%	27%	-3%	-7%	7%
1992	17%	11%	19%	4%	14%	-23%	1%	5%
1993	-7%	-7%	36%	9%	15%	14%	24%	0%
1994	-13%	-11%	24%	-1%	7%	6%	17%	3%
1995	-8%	-7%	11%	-2%	-2%	1%	-4%	-8%
1996	-16%	-2%	6%	3%	10%	1%	-6%	-11%
1997	-25%	-7%	1%	1%	11%	1%	-13%	3%
1998	-7%	-8%	32%	-2%	-3%	2%	-20%	3%
1999	-12%	-5%	17%	-8%	-4%	-6%	-16%	13%
2000	-11%	-3%	-3%	-13%	-5%	-9%	-24%	-17%
2001	-6%	20%	7%	1%	-1%	-7%	-7%	28%
2002	-3%	23%	7%	4%	6%	-3%	24%	25%
2003	-3%	5%	-5%	5%	8%	-3%	35%	1%
2004	-9%	-7%	-16%	-1%	0%	-4%	24%	-1%
2005	10%	-7%	-11%	-5%	11%	-4%	4%	0%
2006	4%	-8%	-11%	-12%	-8%	-14%	-17%	-3%
2007	-13%	1%	-7%	-11%	-16%	-1%	-17%	2%
2008	45%	27%	12%	10%	-13%	11%	-12%	10%
2009	35%	60%	44%	19%	5%	18%	25%	33%

Table 4. Model Forecasting

Panel A: ARIMA Model

Panel A	Athens	Rhodes	Corfu	Crete	Thessaloniki	Kos	Santorini	Mykonos	Zante	Skiathos	Kefalonia	Samos
Latest 2009	3170478	1321806	808098	2554905	1507081	627533	151367	111837	435874	115986	169387	141938
Forecast												
2010	3223090	1430907	790975	2609909	1461271	629969	175156	129413	501925	131895	169134	156888
2011	3072332	1342098	870922	2584453	1540472	624101	148692	109861	464715	113336	169065	154085
2012	3831636	1653480	857742	2606684	1560233	614845	151100	111640	454474	115873	172621	136568
2013	3114084	1306546	857046	2652003	1422416	630336	156771	115830	460542	119775	173379	158618
2014	3362104	1352489	808344	2677652	1428689	618130	149609	110538	470440	116795	181776	161604
2015	3110252	1364970	937485	2845158	1494086	617091	146914	108547	438842	115708	167489	154693
% Forecast												
2010	+2%	+8%	-2%	+2%	-3%	0%	+16%	+16%	+15%	+14%	0%	+11%
2011	-3%	+2%	+8%	+1%	+2%	-1%	-2%	-2%	+7%	-2%	0%	+9%
2012	+21%	+6%	+6%	+2%	+4%	-2%	0%	0%	+4%	0%	+2%	-4%
2013	-2%	-1%	+6%	+4%	-6%	0%	+4%	+4%	+6%	+3%	+2%	+12%
2014	+6%	+2%	0%	+5%	-5%	-2%	-1%	-1%	+8%	+1%	+7%	+14%
2015	-2%	+3%	+16%	+11%	-1%	-2%	-3%	-3%	+1%	0%	-1%	+9%
Correlation												
2010	0.00	0.38	0.22	0.50	0.47	0.38	0.61	0.33	0.24	-0.16	0.08	0.23
2011	0.21	0.27	0.16	0.63	0.48	0.46	0.52	0.80	-0.01	-0.09	0.14	0.43
2012	0.32	0.46	0.40	0.61	0.44	0.49	0.05	0.26	0.29	0.20	-0.06	0.20
2013	-0.23	-0.36	0.19	0.60	0.22	0.56	0.68	0.43	0.04	0.12	0.33	0.22
2014	0.41	0.54	-0.14	0.42	0.45	0.54	0.05	0.15	0.15	0.33	0.13	-0.29
2015	0.58	0.43	0.46	0.13	0.33	0.54	-0.03	0.08	-0.14	-0.02	0.29	-0.10

Panel B: The Holt – Winters (H – W) Exponential Model

Panel B	Athens	Rhodes	Corfu	Crete	Thessaloniki	Kos	Santorini	Mykonos	Zante	Skiathos	Kefalonia	Samos
Latest 2009	3170478	1321806	808098	2554905	1507081	627533	151367	111837	435874	115986	169387	141938
Forecast												
2010	3352541	1361046	850909	2624678	1703218	627368	150617	119096	423625	110269	170325	131102
2011	3389466	1380671	851747	2741626	1786820	641094	166892	124695	418988	117135	176735	132672
2012	3512719	1455486	892611	2866937	1965707	658584	162866	122289	409133	116054	175685	134912
2013	3577662	1468497	921568	2914402	2012110	672237	171285	136507	402536	131956	195617	130328
2014	3675226	1515234	900026	3035046	2087679	717725	191798	132020	402838	132371	203766	143933
2015	3853243	1539695	942836	3075107	2232145	717560	191048	141485	390186	126552	204534	133098
% Forecast												
2010	5.74	2.97	5.30	2.73	13.01	-0.03	-0.50	6.49	-2.81	-4.93	0.55	-7.63
2011	6.91	4.45	5.40	7.31	18.56	2.16	10.26	11.50	-3.87	0.99	4.34	-6.53
2012	10.79	10.11	10.46	12.21	30.43	4.95	7.60	9.35	-6.13	0.06	3.72	-4.95
2013	12.84	11.10	14.04	14.07	33.51	7.12	13.16	22.06	-7.65	13.77	15.49	-8.18
2014	15.92	14.63	11.38	18.79	38.52	14.37	26.71	18.05	-7.58	14.13	20.30	1.41
2015	21.54	16.48	16.67	20.36	48.11	14.35	26.21	26.51	-10.48	9.11	20.75	-6.23
Correlation												
2010	0.39	0.53	0.50	0.49	0.63	0.26	0.78	0.73	0.14	0.47	0.19	0.52
2011	0.70	0.67	0.82	0.78	0.71	0.75	0.94	0.87	0.77	0.80	0.74	0.83
2012	0.84	0.84	0.87	0.89	0.70	0.86	0.96	0.87	0.86	0.87	0.86	0.90
2013	0.80	0.80	0.88	0.90	0.79	0.86	0.98	0.91	0.88	0.92	0.88	0.92
2014	0.80	0.84	0.88	0.92	0.86	0.89	0.98	0.91	0.90	0.92	0.92	0.93
2015	0.76	0.84	0.89	0.92	0.89	0.89	0.99	0.94	0.93	0.90	0.90	0.94

Table 5. Back-tests of the Model Forecasting Performance

Panel A: ARIMA Model

Panel A	Athens	Rhodes	Corfu	Crete	Thessaloniki	Kos	Santorini	Mykonos	Zante	Skiathos	Kefalonia	Samos
Dir Up												
Year 1	60%	60%	60%	81%	79%	76%	69%	69%	67%	52%	60%	57%
2	77%	73%	57%	70%	92%	91%	83%	88%	80%	50%	92%	61%
3	69%	75%	90%	72%	92%	88%	90%	80%	73%	80%	79%	71%
4	82%	79%	50%	93%	85%	88%	88%	88%	85%	47%	90%	67%
5	100%	71%	50%	92%	90%	78%	67%	83%	82%	56%	100%	67%
6	100%	80%	71%	91%	82%	80%	70%	90%	83%	69%	100%	55%
Dir Down												
Year 1	0%	67%	50%	0%	57%	75%	25%	63%	50%	--	44%	--
2	29%	70%	50%	--	29%	44%	29%	62%	--	0%	40%	100%
3	17%	43%	56%	0%	33%	45%	44%	11%	13%	56%	60%	40%
4	14%	0%	0%	25%	60%	20%	40%	10%	20%	33%	38%	50%
5	50%	10%	29%	25%	57%	13%	0%	0%	0%	50%	25%	20%
6	0%	17%	50%	0%	0%	17&	0%	0%	0%	67%	0%	40%
MAE												
Year 1	-0.013	-0.010	0.005	-0.015	-0.001	-0.014	-0.083	-0.053	0.0003	0.089	-0.104	0.081
2	-0.037	-0.033	-0.036	-0.074	-0.013	-0.069	-0.256	-0.212	-0.090	0.013	-0.113	0.045
3	-0.066	-0.095	-0.060	-0.141	-0.051	-0.123	-0.402	-0.295	-0.194	-0.127	-0.232	0.010
4	-0.140	-0.123	-0.080	-0.212	-0.010	-0.177	-0.661	-0.418	-0.284	-0.126	-0.342	-0.069
5	-0.160	-0.177	-0.110	-0.262	-0.134	-0.198	-0.683	-0.414	-0.373	-0.191	-0.403	-0.051
6	-0.199	-0.202	-0.137	-0.311	-0.161	-0.223	-0.945	-0.584	-0.456	-0.154	-0.470	-0.053
RMSE												
Year 1	0.062	0.048	0.024	0.072	0.003	0.068	0.389	0.249	0.002	0.416	0.488	0.382
2	0.171	0.151	0.164	0.337	0.059	0.318	1.172	0.973	0.413	0.060	0.517	0.206
3	0.297	0.425	0.267	0.632	0.229	0.550	1.796	1.341	0.868	0.566	1.037	0.043
4	0.611	0.535	0.349	0.925	0.423	0.771	2.883	1.824	1.239	0.551	1.492	0.292
5	0.678	0.753	0.466	1.113	0.570	0.838	2.896	1.756	1.580	0.809	1.708	0.217
6	0.822	0.832	0.565	1.281	0.662	0.921	3.894	2.408	1.882	0.633	1.939	0.220

Panel B: The Holt – Winters (H – W) Exponential Model

Panel B	**Athens**	**Rhodes**	**Corfu**	**Crete**	**Thessaloniki**	**Kos**	**Santorini**	**Mykonos**	**Zante**	**Skiathos**	**Kefalonia**	**Samos**
Dir Up												
Year 1	62%	53%	63%	81%	69%	65%	77%	67%	62%	62%	63%	62%
2	87%	60%	83%	82%	94%	81%	93%	75%	78%	77%	100%	78%
3	88%	75%	85%	82%	94%	87%	81%	89%	83%	83%	81%	100%
4	88%	100%	83%	94%	85%	100%	87%	100%	88%	75%	93%	82%
5	93%	100%	83%	94%	86%	100%	100%	94%	88%	78%	87%	91%
6	100%	93%	91%	100%	92%	100%	92%	93%	88%	91%	100%	90%
Dir Down												
Year 1	-	50%	60%	-	38%	25%	38%	56%	-	63%	60%	50%
2	60%	60%	88%	100%	67%	50%	80%	25%	0%	86%	80%	64%
3	100%	67%	67%	100%	67%	100%	67%	100%	100%	71%	100%	75%
4	50%	100%	83%	100%	60%	75%	100%	67%	100%	100%	75%	71%
5	50%	100%	100%	100%	100%	100%	100%	100%	-	75%	0%	67%
6	0%	100%	100%	100%	33%	100%	67%	0%	-	100%	-	100%
MAE												
Year 1	0.013	0.004	0.005	-0.002	-0.013	0.001	-0.005	-0.007	0.010	-0.007	0.001	-0.010
2	0.007	0.000	-0.001	-0.006	-0.013	-0.006	-0.054	-0.036	-0.004	-0.019	0.049	-0.022
3	0.006	-0.002	0.001	-0.006	-0.012	-0.004	-0.052	-0.046	0.001	-0.018	0.074	-0.023
4	0.007	-0.002	0.007	-0.002	-0.017	-0.002	-0.070	0.002	0.012	-0.007	0.050	-0.020
5	0.015	0.006	0.014	0.014	-0.028	0.013	0.024	0.009	0.021	0.028	0.132	-0.004
6	0.018	0.009	0.014	0.015	-0.029	0.016	0.005	0.022	0.005	0.046	0.126	0.013
RMSE												
Year 1	0.061	0.020	0.025	0.011	0.063	0.004	0.023	0.035	0.048	0.035	0.005	0.049
2	0.033	0.001	0.003	0.029	0.060	0.030	0.248	0.165	0.018	0.086	0.049	0.100
3	0.025	0.009	0.006	0.025	0.054	0.018	0.234	0.208	0.004	0.082	0.074	0.101
4	0.032	0.008	0.032	0.011	0.074	0.010	0.305	0.009	0.054	0.031	0.050	0.085
5	0.065	0.027	0.058	0.057	0.118	0.054	0.101	0.039	0.089	0.120	0.132	0.019
6	0.074	0.037	0.057	0.060	0.118	0.067	0.021	0.089	0.022	0.190	0.126	0.054

Table 6. Phillips-Peron Tests for Unit Root on Each Series

Destination	Levels	First Difference
Athens	-6.162725*	---
Rhodes	-4.823538*	---
Corfu	-4.676152*	---
Crete	-4.742771*	---
Thessaloniki	-7.181916*	---
Kos	-5.899760*	---
Santorini	-3.877644*	---
Mykonos	-3.913321*	---
Zante	-5.045585*	---
Skiathos	-4.633233*	---
Kefalonia	-5.006043*	---
Samos	-5.752650*	---
Unemployment Levels		
U.K.	-1.438080	-5.586864*
U.S	-1.062862	-22.12626*
Japan	-1.279496	-20.80571*
France	-3.058265	-9.941293*
Germany	-1.537903	-10.48134*
Netherlands	-2.158326	-21.10112*
Italy	-2.186152	-20.88621*
Turkey	-1.700276	-13.48170*

Note: * implies rejection of the null hypothesis of a unit root $\delta_1 = 0$ at the 1% level of significance.

Table 7. VAR Model Estimations on Unemployment Changes and Tourism Arrivals

	Athens	Rhodes	Corfu	Crete	Thessaloniki	Kos	Santorini	Mykonos	Zante	Skiathos	Kefalonia	Samos
c	0.031794	0.084193	0.078791	0.097078	0.073053	0.015252	0.037774	0.027804	0.031686	0.040911	0.043645	0.035236
	[7.25695]	[15.7526]	[16.1156]	[17.2764]	[12.0419]	[6.36181]	[11.8750]	[13.1008]	[9.42228]	[12.7667]	[12.3315]	[9.52846]
$LARR_{t-1}$	0.658177	0.662046	0.512799	0.520198	0.336827	1.036654	0.844414	0.979995	0.985971	0.830256	0.929791	0.825706
	[12.9765]	[13.2690]	[10.3708]	[10.2495]	[6.27194]	[20.8245]	[16.8723]	[20.7177]	[19.5237]	[16.5627]	[19.1089]	[16.6327]
$LARR_{t-2}$	0.289102			0.187625	0.240754	-0.464466		-0.156265	-0.205247		-0.289649	-0.260516
	[4.82009]			[3.56862]	[4.70960]	[-6.53378]		[-2.34117]	[-2.84236]		[-4.37094]	[-4.27498]
$LARR_{t-3}$	-0.203669				0.124569	0.383020	0.165691	-0.169954				
	[-4.17425]				[2.42460]	[4.96227]	[2.54342]	[-3.82891]				
$LARR_{t-4}$	---			-0.255719	-0.237028	-0.120956	-0.316704	---	---		0.167451	---
	---			[-3.99275]	[-4.76052]	[-2.27041]	[-7.04008]	---	---		[2.59696]	---
$LARR_{t-5}$	---	-0.427145	-0.515540	-0.306224	-0.160294	---	---	---	---	-0.271209	-0.264590	---
	---	[-7.51236]	[-9.85221]	[-6.13282]	[-3.65798]	---	---	---	---	[-5.42101]	[-5.42116]	---
$\Delta UNUK_{t-1}$												
$\Delta UNUK_{t-2}$		-0.137810		-0.136989								
		[-2.04735]		[-2.40069]								
$\Delta UNUK_{t-3}$								0.054467				
								[2.05572]				
$\Delta UNUK_{t-4}$	---							---	---			---
	---							---	---			---
$\Delta UNUK_{t-5}$	---					---	---	---	---			---
	---					---	---	---	---			---
$\Delta UNUS_{t-1}$										0.023041	0.015998	
										[1.99268]	[2.19296]	
$\Delta UNUS_{t-2}$												
$\Delta UNUS_{t-3}$												0.023511
												[2.01428]
$\Delta UNUS_{t-4}$	---							---	---			---
	---							---	---			---
$\Delta UNUS_{t-5}$	---					---	---	---	---			---
	---					---	---	---	---			---

Table 7. ***Continued***

	Athens	Rhodes	Corfu	Crete	Thessaloniki	Kos	Santorini	Mykonos	Zante	Skiathos	Kefalonia	Samos
$\Delta UNJP_{t-1}$		0.020561		0.020508	0.011292			0.008516				
		[2.17632]		[2.53792]	[2.78580]			[2.12026]				
$\Delta UNJP_{t-2}$												
$\Delta UNJP_{t-3}$												
$\Delta UNJP_{t-4}$	---							---	---			---
	---							---	---			---
$\Delta UNJP_{t-5}$	---	0.026119		0.025103	0.007940	---	---	---	---	0.004647	0.002384	---
	---	[2.73919]		[3.09152]	[1.97656]	---	---	---	---	[0.90496]	[0.73661]	---
$\Delta UNFR_{t-1}$	-0.026157					-0.066669	-0.034556	-0.056700	-0.051540	-0.075925	-0.064340	-0.045278
	[-4.51936]					[-3.74869]	[-2.88745]	[-4.37548]	[-4.19027]	[-4.53192]	[-6.13686]	[-2.87454]
$\Delta UNFR_{t-2}$					-0.039671	-0.102699	-0.028305	-0.039697		-0.038984	-0.025725	
					[-3.07005]	[-5.64446]	[-2.37435]	[-3.01522]		[-2.24164]	[-2.37601]	
$\Delta UNFR_{t-3}$	-0.029757	-0.070165	-0.104688		-0.057758	-0.068506	-0.052805	-0.069313	-0.060521	-0.087034	-0.061844	-0.087920
	[-5.06785]	[-2.27501]	[-3.39122]		[-4.57642]	[-3.59478]	[-4.41252]	[-5.26648]	[-4.92352]	[-5.13255]	[-5.83872]	[-5.87846]
$\Delta UNFR_{t-4}$	---	-0.155760	-0.103888	-0.222857	-0.059924			---	---			---
	---	[-4.88989]	[-3.20647]	[-8.34567]	[-4.41601]			---	---			---
$\Delta UNFR_{t-5}$	---					---	---	---	---	-0.060230	-0.047672	---
	---					---	---	---	---	[-3.27897]	[-4.12641]	---
$\Delta UNGR_{t-1}$	-0.014535				-0.039404					0.036616		-0.023742
	[-4.61488]				[-4.96113]					[3.47202]		[-2.95713]
$\Delta UNGR_{t-2}$	0.015013	0.082431		0.072109	0.024585	0.042935					0.019777	
	[4.32192]	[4.12821]		[4.38701]	[3.09410]	[3.83961]					[3.34197]	
$\Delta UNGR_{t-3}$		0.077683	0.056360	0.098265		0.025496	-0.026329	-0.036839		-0.056156	-0.021125	-0.018071
		[4.03934]	[2.99049]	[5.93116]		[2.17628]	[-3.99831]	[-5.25064]		[-5.66972]	[-3.30701]	[-2.12706]
$\Delta UNGR_{t-4}$	---	-0.112882	-0.069327	-0.090163	-0.019418	-0.058667		---	---	0.028298		---
	---	[-5.71128]	[-3.77595]	[-5.06908]	[-2.32489]	[-5.45404]		---	---	[2.88810]		---
$\Delta UNGR_{t-5}$	---				0.016914	---	---	---	---			---
	---				[1.99843]	---	---	---	---			---

Table 7. ***Continued***

	Athens	Rhodes	Corfu	Crete	Thessaloniki	Kos	Santorini	Mykonos	Zante	Skiathos	Kefalonia	Samos
$\Delta UNNL_{t-1}$	0.005519					-0.035436	-0.025581	-0.034869	-0.020300	-0.028802	-0.011253	-0.029052
	[2.12291]					[-4.51360]	[-5.43768]	[-6.79570]	[-3.90375]	[-3.82373]	[-2.38855]	[-4.54383]
$\Delta UNNL_{t-2}$	0.011592		-0.029883	0.027836	0.037501			0.012586				-0.018927
	[4.50652]		[-2.03460]	[2.38250]	[6.65983]			[2.20463]				[-2.79764]
$\Delta UNNL_{t-3}$	-0.007086						0.022405	0.034085	0.017720	0.038466	0.019001	0.019589
	[-2.95793]						[4.40671]	[6.30100]	[3.56589]	[5.17135]	[4.11027]	[3.02133]
$\Delta UNNL_{t-4}$	---	0.057988	0.092615	0.035666		0.049032	0.024996	---	---		0.015018	---
	---	[4.64624]	[7.03805]	[3.40030]		[6.54519]	[5.07698]	---	---		[3.24758]	---
$\Delta UNNL_{t-5}$	---	-0.055214	-0.040531	-0.070366	-0.026970	---	---	---	---	-0.005929	-0.010725	---
	---	[-3.98677]	[-2.83139]	[-5.91217]	[-4.44210]	---	---	---	---	[-0.77794]	[-2.29069]	---
$\Delta UNIT_{t-1}$												
$\Delta UNIT_{t-2}$												
$\Delta UNIT_{t-3}$												0.022311
												[2.04427]
$\Delta UNIT_{t-4}$	---				0.023640			---	---			---
	---				[2.55930]			---	---			---
$\Delta UNIT_{t-5}$	---	-0.079331	-0.073076	-0.049579		---	---	---	---			---
	---	[-3.74533]	[-3.39504]	[-2.77199]		---	---	---	---			---
$\Delta UNTK_{t-1}$												
$\Delta UNTK_{t-2}$	-0.007681											
	[-2.38418]											
$\Delta UNTK_{t-3}$												
$\Delta UNTK_{t-4}$	---		-0.029858	-0.025219	-0.019595		-0.012086	---	---			---
	---		[-1.98734]	[-1.98070]	[-3.05812]		[-2.14743]	---	---			---
$\Delta UNTK_{t-5}$	---					---	---	---	---			---
	---					---	---	---	---			---
Adj. R^2	0.774404	0.895391	0.877587	0.920579	0.828163	0.873744	0.908633	0.919658	0.840129	0.907837	0.896236	0.780249
F-statistic	45.26092	73.46996	60.74205	99.13857	41.80488	74.43341	106.5263	163.3752	75.54353	84.39955	74.12861	51.36604

Appendix 1

Employment Levels From Countries of Tourists' Origin

	UK	US	JAPAN	FRANCE	GERMANY	ITALY	NETHERLANDS	TURKEY
1977	24866	92017	53420	21493	25884	20145	4701	#N/A
1978	25014	96048	54080	21567	26021	20217	4757	#N/A
1979	25393	98824	54790	21696	26347	20406	4821	#N/A
1980	25327	99303	55360	21747	26874	20674	4970	#N/A
1981	24345	100397	55810	21644	26947	20725	5072	#N/A
1982	23907	99526	56380	21710	26774	20668	5010	5328
1983	23624	100834	57330	21694	26477	20725	4950	6075
1984	24235	105005	57660	21509	26608	20809	4980	6317
1985	24539	107150	58070	21450	26626	20894	5076	16162
1986	24568	109597	58530	21551	26940	21006	5155	#N/A
1987	25083	112440	59110	21631	27083	20986	5251	#N/A
1988	25914	114968	60110	21830	27366	21253	6032	18445
1989	26684	117342	61280	22146	27742	21154	6155	18856
1990	27191	118793	62490	22381	29334	21454	6356	19946
1991	26305	117718	63690	22420	29684	21595	6521	19022
1992	25728	118492	64360	22002	30094	21609	6597	19085
1993	25317	120259	64500	21714	29782	20705	6648	18047
1994	#N/A	123060	64530	21750	29397	20373	6692	19401
1995	27660	124900	64570	21954	36048	20233	6835	19893
1996	27967	126708	64860	22036	35982	20320	6971	20388
1997	28468	129558	65570	22167	35805	20413	7194	20362
1998	28651	131463	65140	22695	35860	20618	7435	20872
1999	29037	133488	64620	23080	36402	20864	7613	21413
2000	29509	135208	64460	23689	36604	21225	7798	21581
2001	29824	135073	64120	24146	36816	21634	7953	21524
2002	29974	136485	63300	24316	36536	21922	8018	21354
2003	30264	137736	63160	24325	36172	22133	7991	21147
2004	30543	139252	63290	24346	35659	22404	7928	21791
2005	30776	141730	63560	24498	36566	22563	7958	22046
2006	28929	144427	63820	24746	37322	22988	8108	22330
2007	29129	146047	64120	25093	38210	23222	8464	20738
2008	29346	145362	63850	25951	38880	23405	8593	21194
2009	28880	139877	62242	25755	38324	22765	8542	#N/A

Appendix 2

VAR Model Specification Optimal Lags – Schwartz Information Criterion

$$LARR_t = c + \sum_{i=n} b_i LARR_{t-n} + \sum_{i=n} b_i \Delta LU_{t-i} + u_t$$

Destination	**Optimal Number of Lags (*n*)**
Athens	n = 3
Rhodes	n = 5
Corfu	n = 5
Crete	n = 5
Thessaloniki	n = 5
Kos	n = 4
Santorini	n = 4
Mykonos	n = 3
Zante	n = 3
Skiathos	n = 5
Kefalonia	n = 5
Samos	n = 3

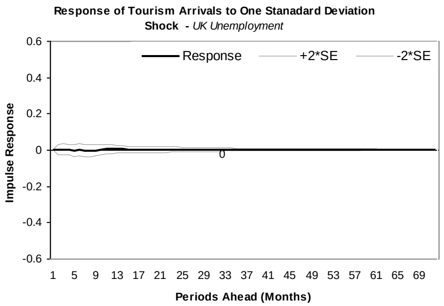
Notes: The term $\sum_{i=n} b_i \Delta LU_{t-i}$ represents the change in unemployment for the UK (*UNUK*), US (*UNUS*), Japan (*UNJP*), France (*UNFR*), Germany (*UNGR*), the Netherlands (*UNNL*), Italy (*UNIT*) and Turkey (*UNTK*)

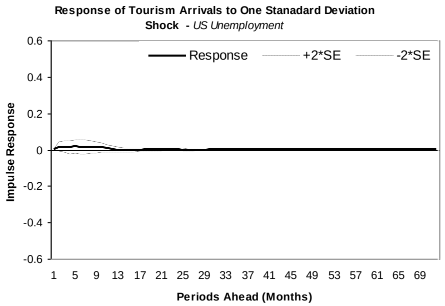
$$\sum_{i=n} b_i \Delta LU_{t-i} = \sum_{n} b_n \Delta UNUK_{t-n} + \sum_{n} b_n \Delta UNUS_{t-n} + \sum_{n} b_n \Delta UNJP_{t-n} + \sum_{n} b_n \Delta UNFR_{t-n} + ...+$$

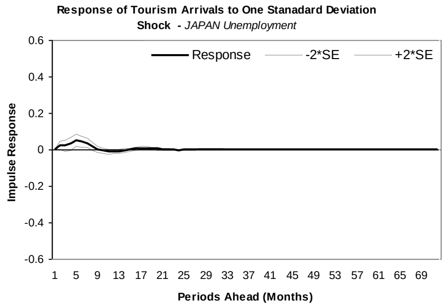
$$\sum_{n} b_n \Delta UNGR_{t-n} + \sum_{n} b_n \Delta UNNL_{t-n} + \sum_{n} b_n \Delta UNIT_{t-n} + .\sum_{n} b_n \Delta UNTK_{t-n} + u_t$$

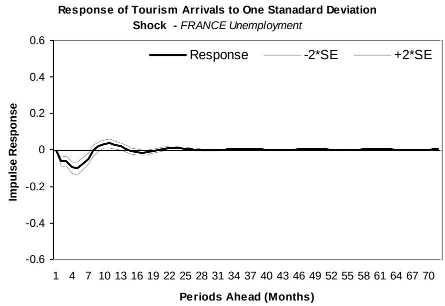
Appendix 3(a):

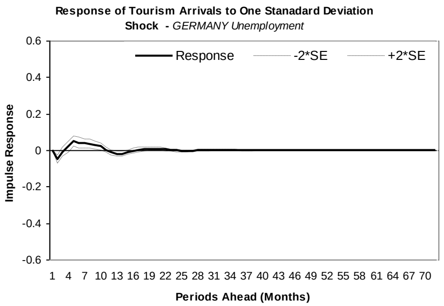
Impulse Response on Arrivals in Athens – Unemployment Shocks From Country of Origin

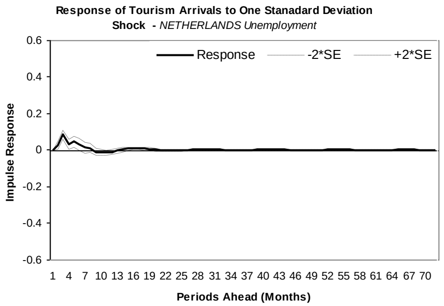


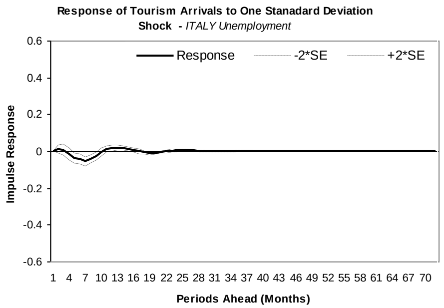


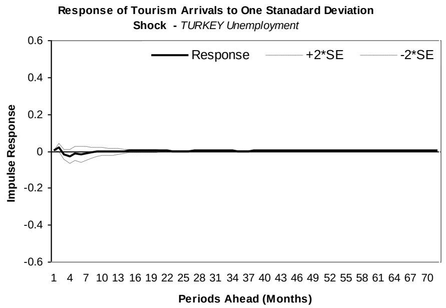






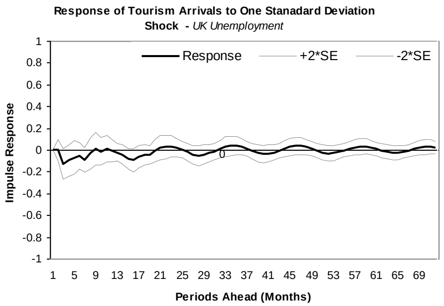


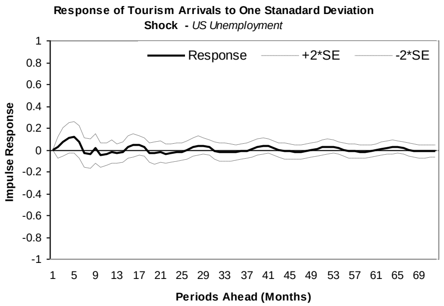


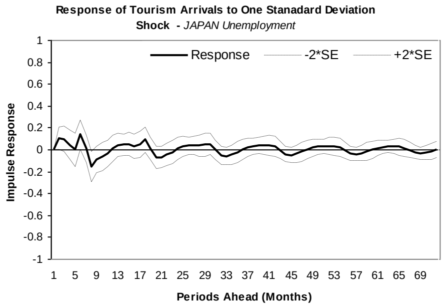


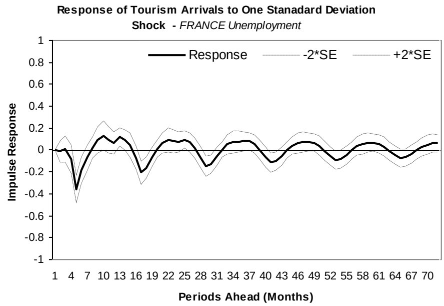
Appendix 3 (b):

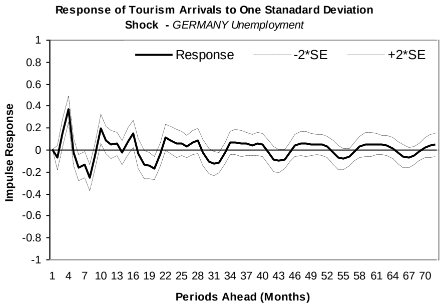
Impulse Response on Arrivals in Rhodes – Unemployment Shocks From Country of Origin

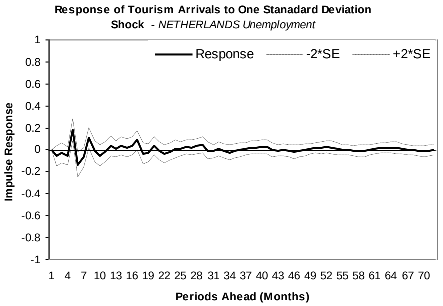


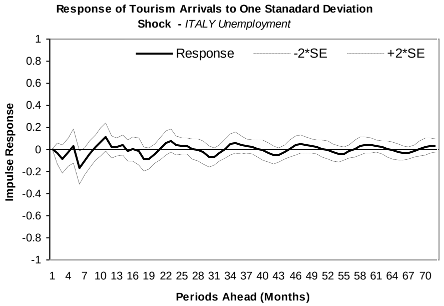


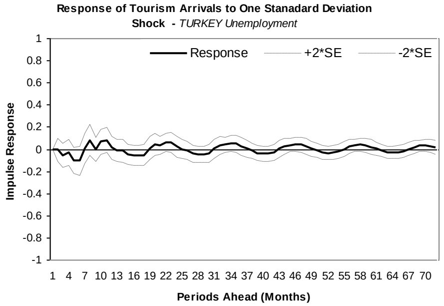






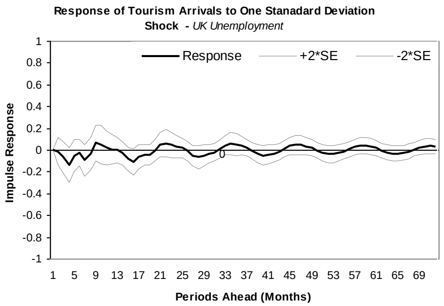


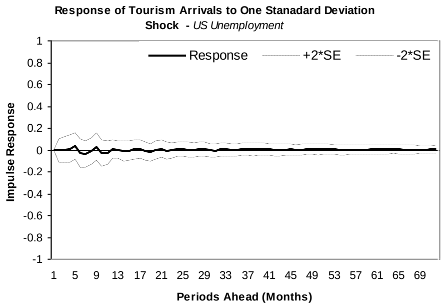


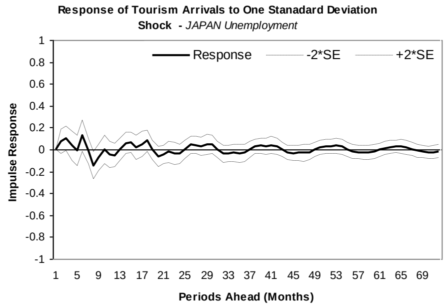


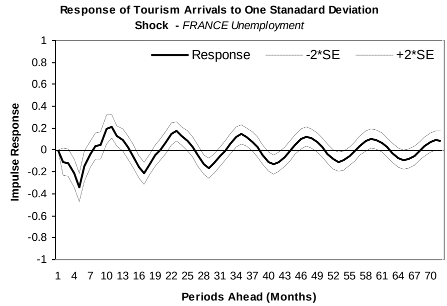
Appendix 3 (c):

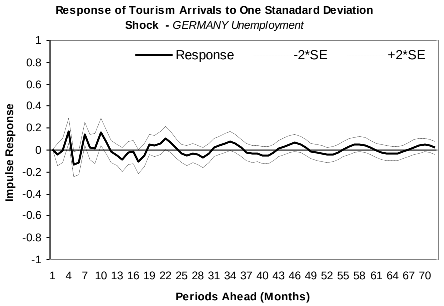
Impulse Response on Arrivals in Corfu – Unemployment Shocks From Country of Origin

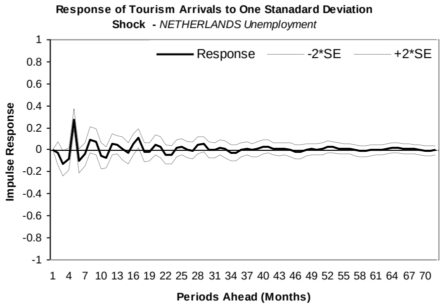


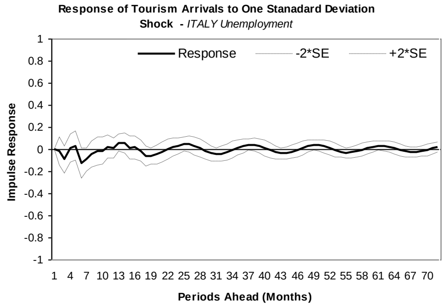


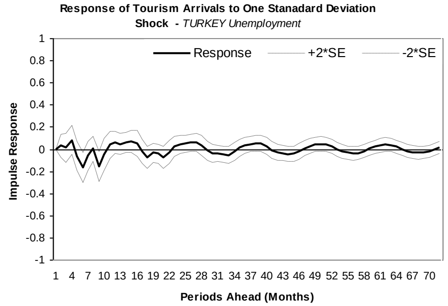






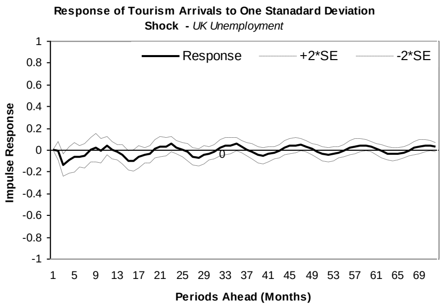


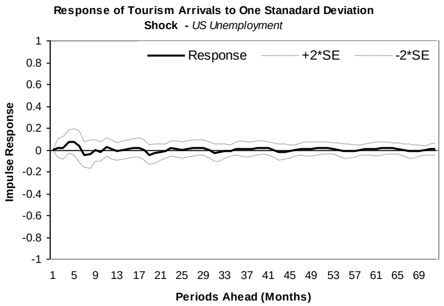


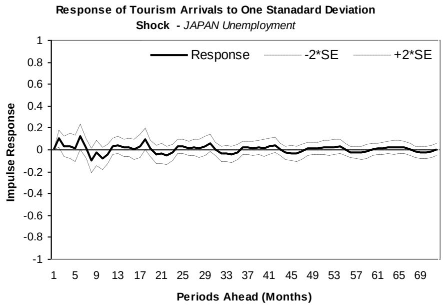


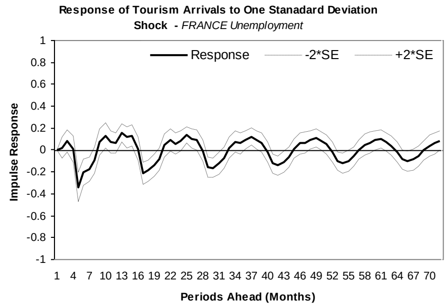
Appendix 3 (d):

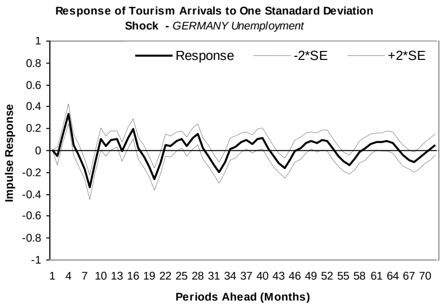
Impulse Response on Arrivals in Crete – Unemployment Shocks From Country of Origin

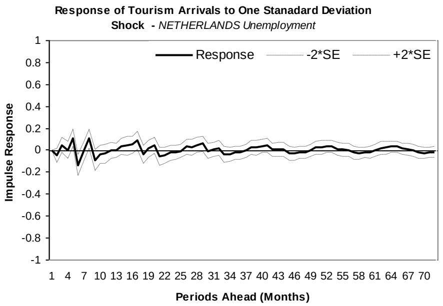


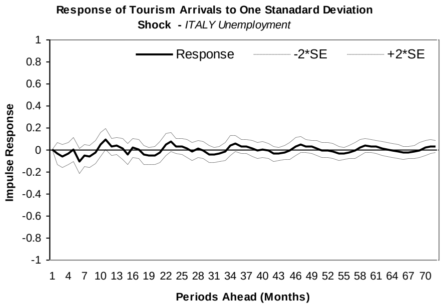


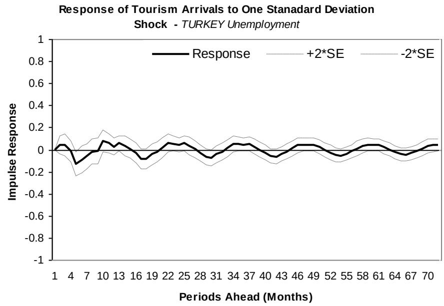






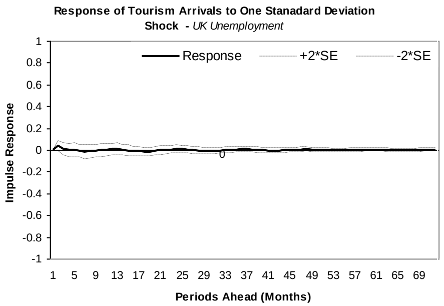


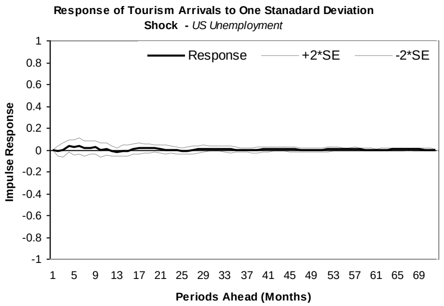


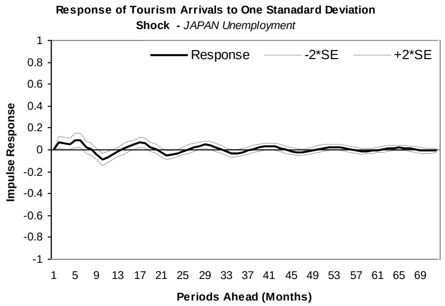


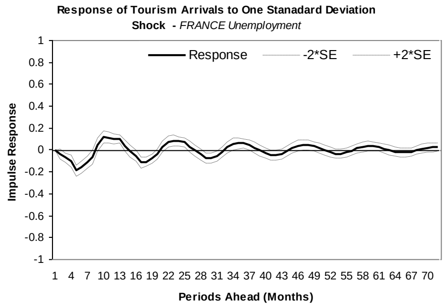
Appendix 3 (e):

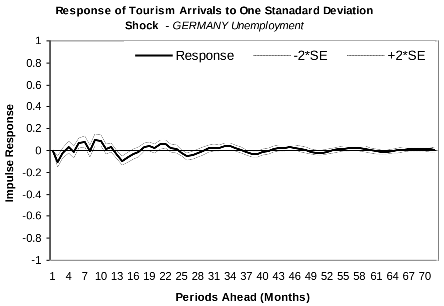
Impulse Response on Arrivals in Thessaloniki – Unemployment Shocks From Country of Origin

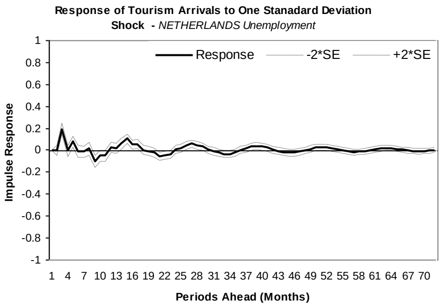


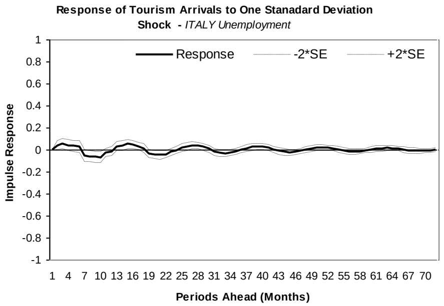


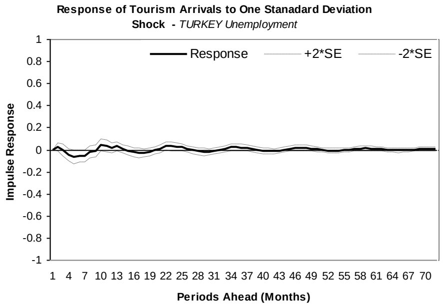






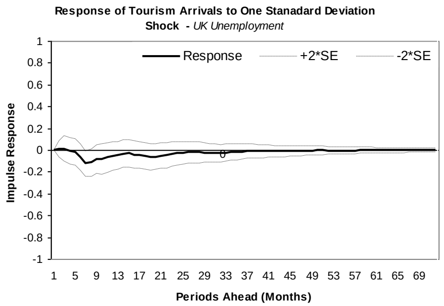


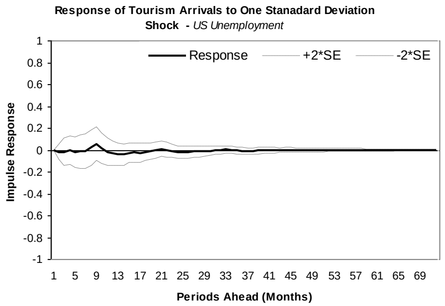


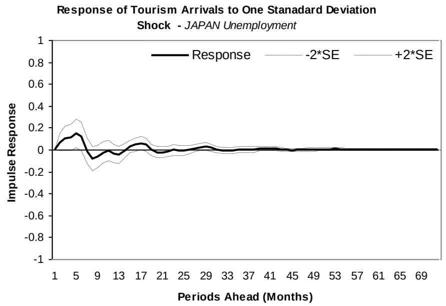


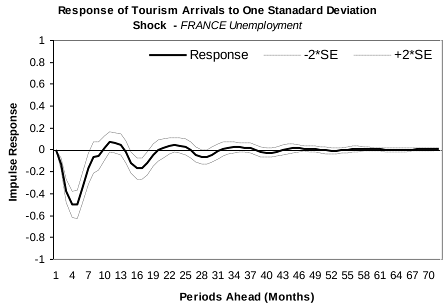
Appendix 3 (f):

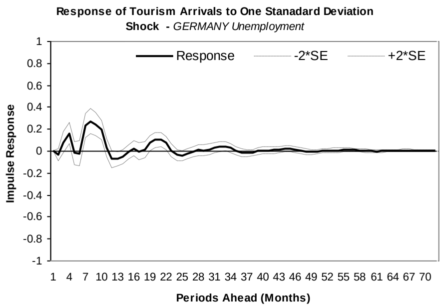
Impulse Response on Arrivals in Kos – Unemployment Shocks From Country of Origin

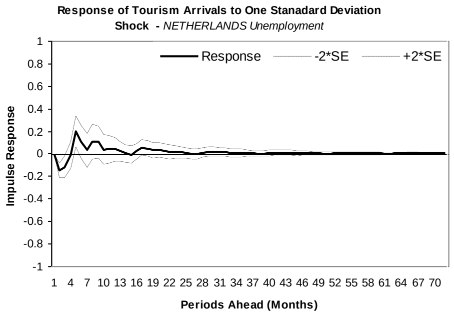


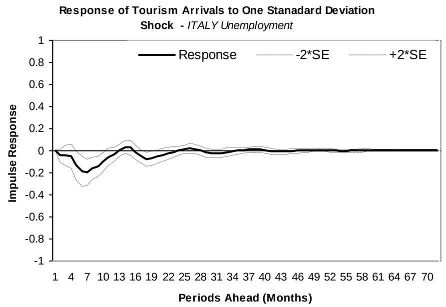


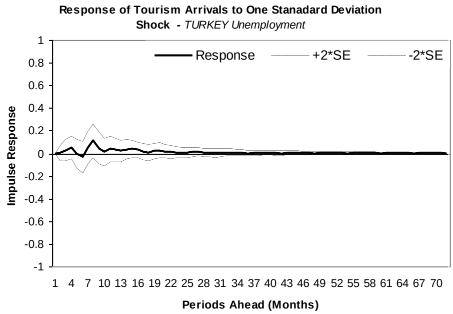






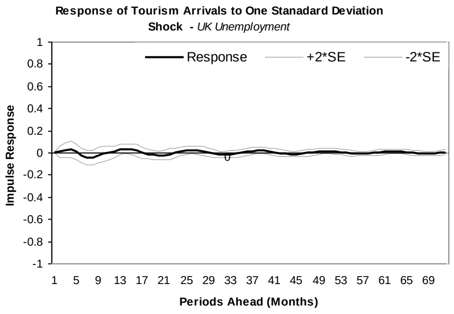


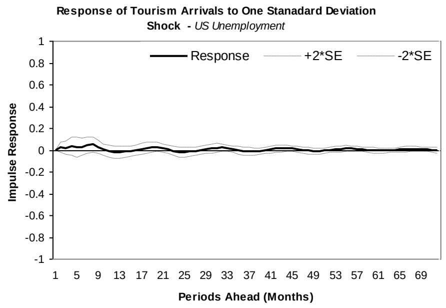


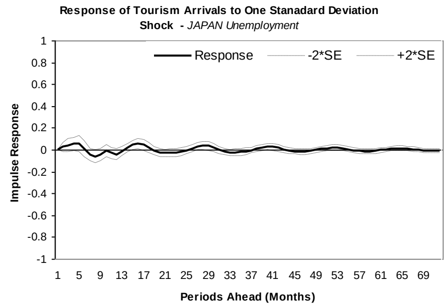


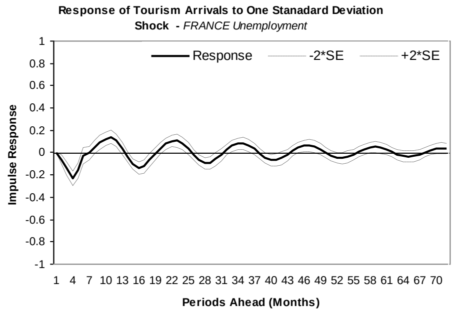
Appendix 3 (g):

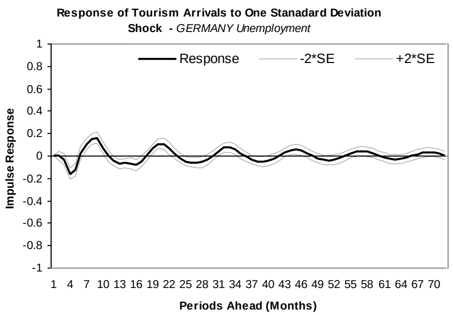
Impulse Response on Arrivals in Santorini – Unemployment Shocks From Country of Origin

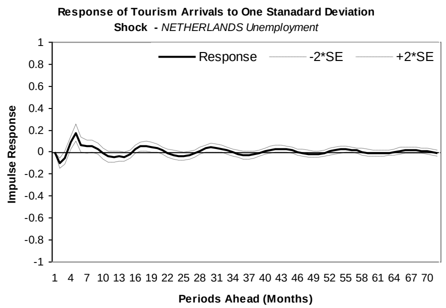


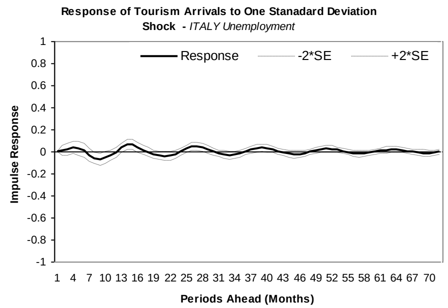


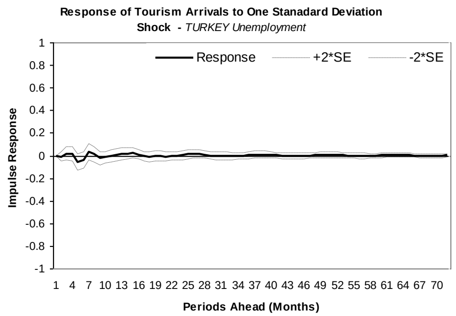






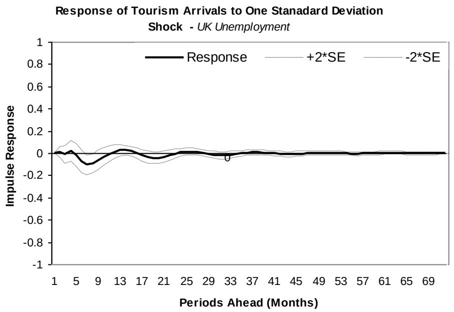


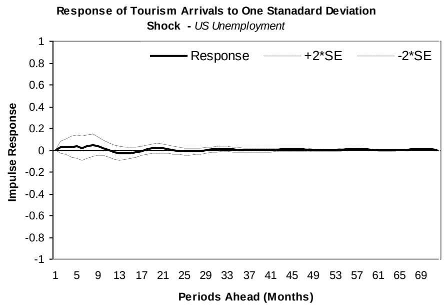


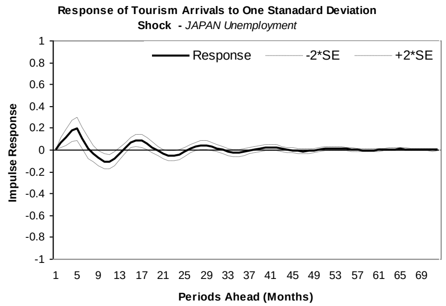


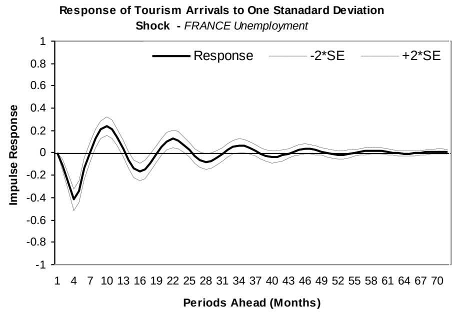
Appendix 3 (h):

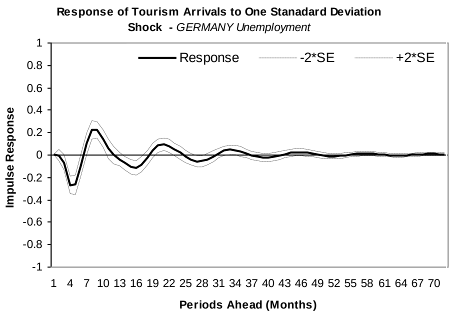
Impulse Response on Arrivals in Mykonos – Unemployment Shocks From Country of Origin

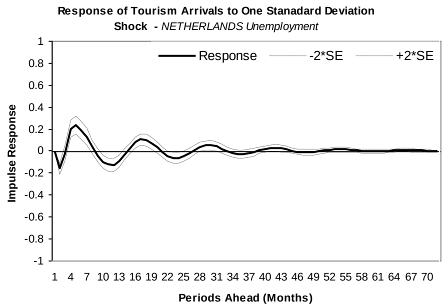


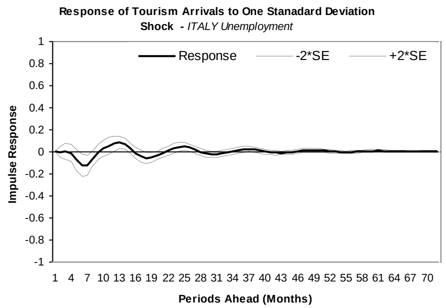


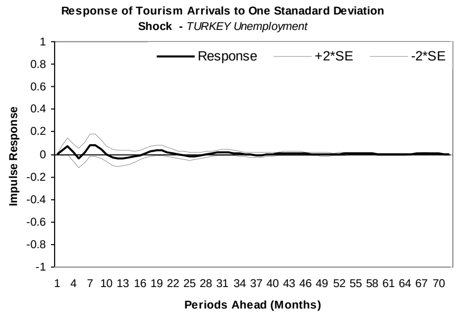






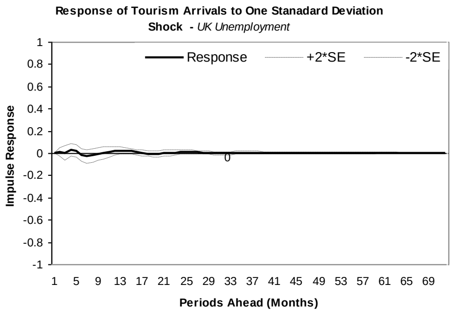


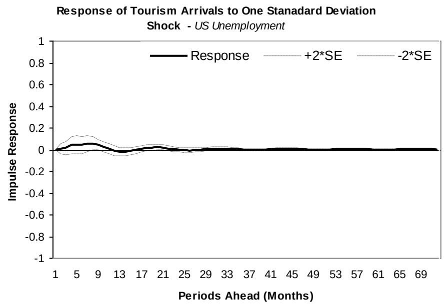


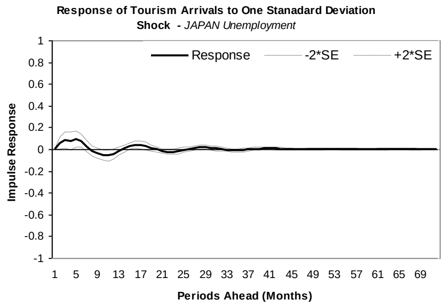


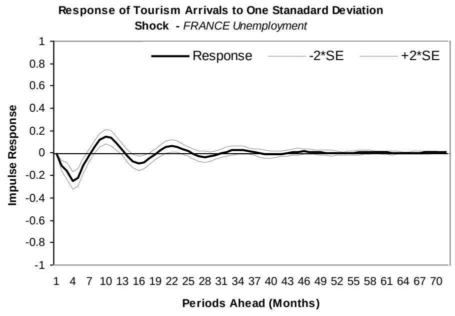
Appendix 3 (i):

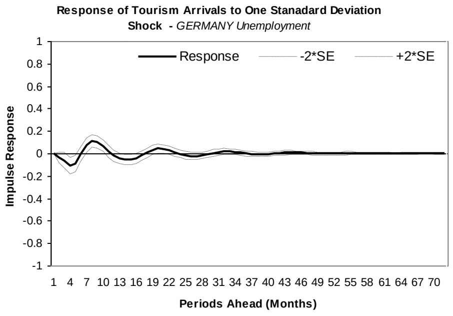
Impulse Response on Arrivals in Zante – Unemployment Shocks From Country of Origin

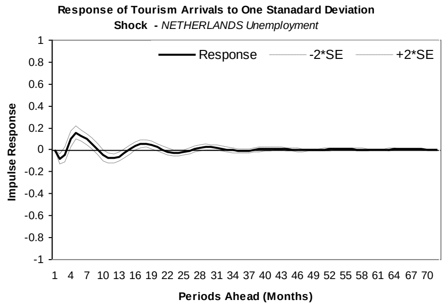


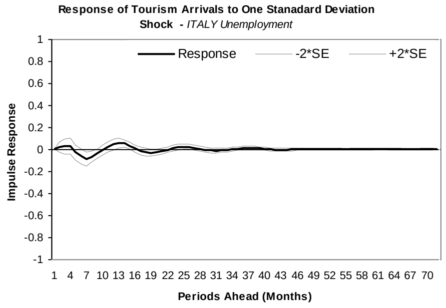


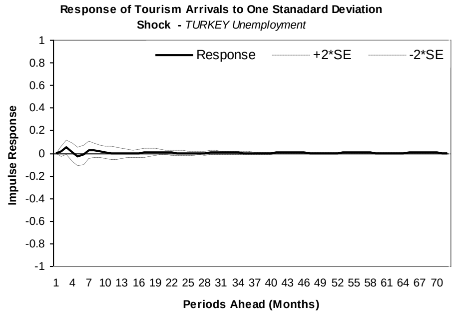






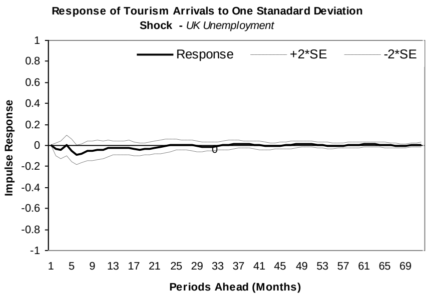


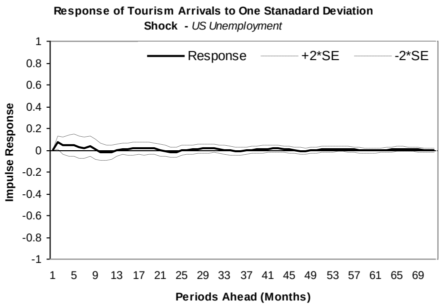


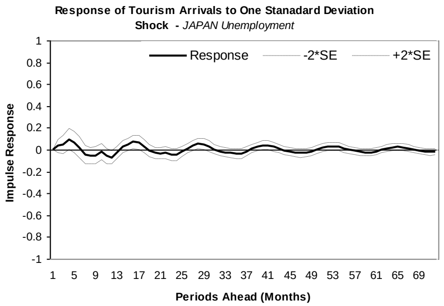


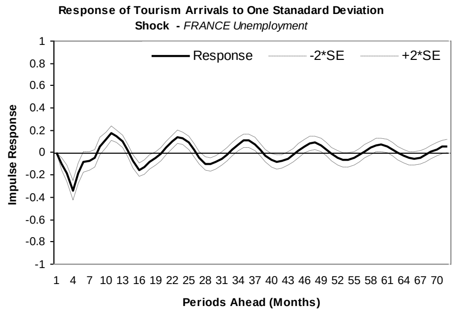
Appendix 3 (j):

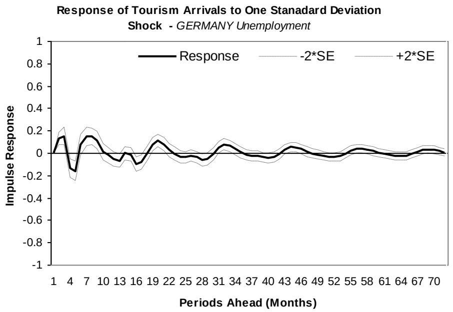
Impulse Response on Arrivals in Skiathos – Unemployment Shocks From Country of Origin

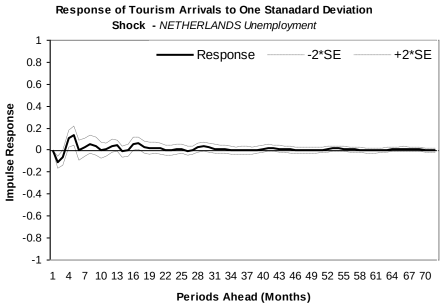


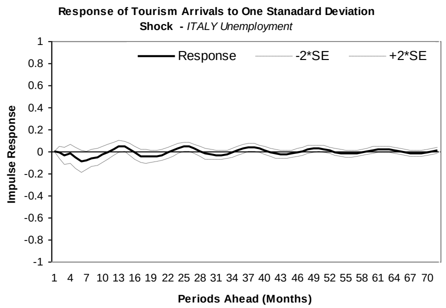


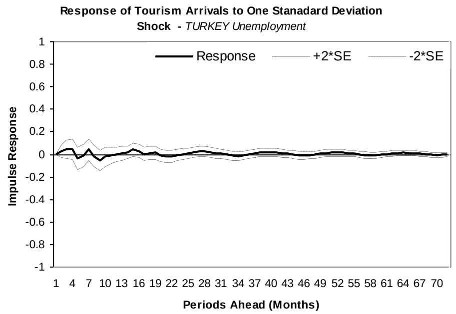






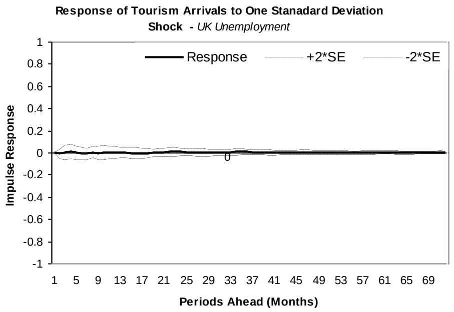


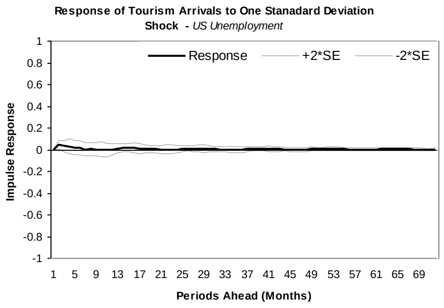


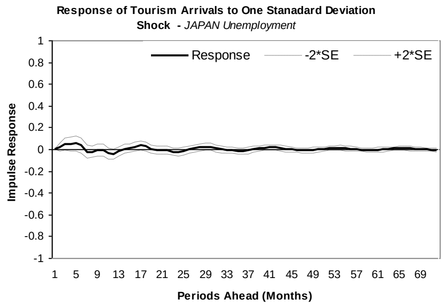


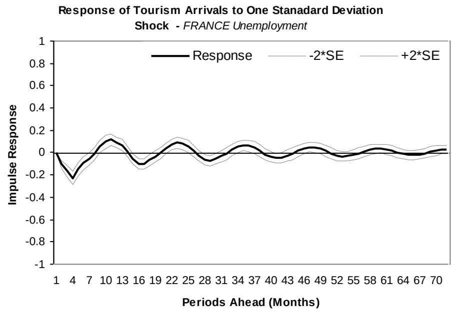
Appendix 3 (k):

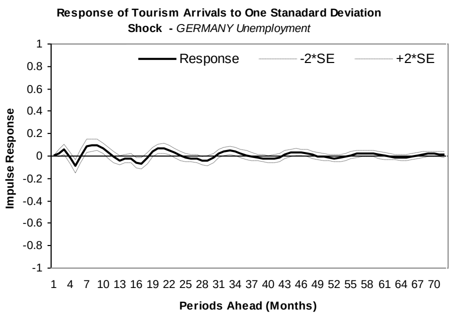
Impulse Response on Arrivals in Kefalonia – Unemployment Shocks From Country of Origin

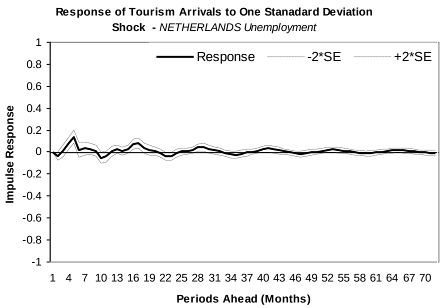


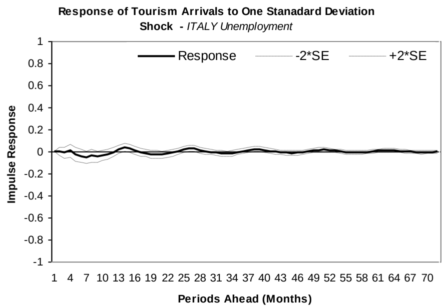


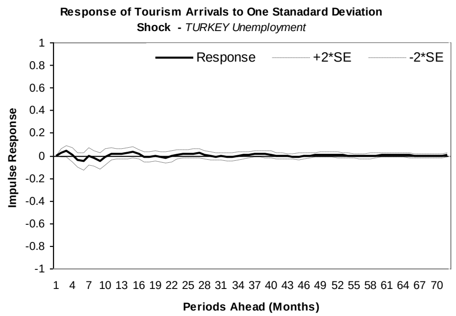












Appendix 3 (l):

Impulse Response on Arrivals in Samos – Unemployment Shocks From Country of Origin